# Muelleria

Plant, Algal and Fungal Taxonomy and Systematics

Vol 33, 2014–2015

REFERENCE

Royal Botanic Gardens Melbourne

***Podolepis robusta* (Maiden & Betche) J.H.Willis**
**Source: State Botanical Collection**
**Illustration: Betty Conabere (1976)**
*Podolepis robusta* is commonly known as Alpine Podolepis or Mountain Lettuce. Type material was collected near Kiandra, Kosciuszko National Park, by Ernst Betche in 1897. James Maiden and Betche were experienced taxonomic and economic botanists who published extensively on the 'colonial flora' of NSW. Both corresponded and exchanged specimens with Ferdinand von Mueller.

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Podolepis robusta

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# Muelleria

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# Taxonomic reassessment of *Kelleria* (Thymelaeaceae) in Australia and recognition of a new endemic Victorian species

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## Abstract

Victorian plants previously referred to *Kelleria laxa* (Cheeseman) Heads were found by multivariate analysis of morphological data to be distinct from New Zealand plants of that name. The Victorian plants are here named as *Kelleria bogongensis* Marks and their ecology and conservation status are discussed.

***Key words:*** *Kelleria*, new species, Bogong High Plains

## Introduction

Prior to 1980, the dwarf, carpeting shrub, then known as *Drapetes tasmanicus* Hook.f. (Thymelaeaceae) was known only from alpine areas in Kosciuszko National Park, New South Wales, and similar habitats in Tasmania. The discovery in 1980 of a small population of apparently the same entity on the Bogong High Plains, Victoria, filled an apparent gap in the species' distribution. Heads's revision of the genus (1990a, b) resurrected *Kelleria* Endl. from *Drapetes* Banks, assigned the Australian species to *Kelleria*, and recognised the Kosciuszko and Tasmanian populations as *K. dieffenbachii* (Hook.) Endl. and treated the Victorian population as a distinct species, *K. laxa* (Cheeseman) Heads. Both species have long been known from New Zealand mountains. *Kelleria laxa* is distinguished, *inter alia*, but perhaps most significantly, from *K. dieffenbachii* by having vegetative buds in the flower heads that grow on after anthesis, whereas *K. dieffenbachii* lacks vegetative buds in the flower heads. Comparison of herbarium material of Australian and New Zealand representatives of *K. laxa* indicated sufficient differences to warrant closer scrutiny. A morphological analysis was undertaken to determine the variation in *K. dieffenbachii* and *K. laxa* from across their known ranges. A molecular analysis employing the nuclear ribosomal ITS and the chloroplast trnL-F DNA regions was also performed on a

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limited number of specimens (seven) representing the same taxa and geographic regions as the morphological analysis. Results of the molecular analysis showed no clear pattern and are not further discussed here, but the data are available from the authors on request.

## Morphological study

A list of characters was compiled employing those characters that have been used in literature (e.g. Allan 1961; Heads 1990a, b) to distinguish *Kelleria laxa* and *K. dieffenbachii*, as well as characters that were observed to differ across the ecological and geographic range of the species (Table 1). Ninety-six herbarium specimens from three Australian (CANB, HO, MEL) and two New Zealand (AK, CHR) herbaria (abbreviations follow Thiers, continually updated) were scored for these 26 characters, which included continuous, binary and multistate characters. Collection details are available from the authors on request.

**Table 1.** Twenty-six morphological characters used to score specimens for multivariate analyses of Australian and New Zealand *Kelleria*

| | |
|---|---|
| 1. | Length of short shoot (mm) |
| 2. | Length of leaf persistence on short shoot (mm) |
| 3. | Leaves persistent on all of short shoot (0) or caducous (1) |
| 4. | Leaves present on long shoot (0) or only on short shoot (1) |
| 5. | Stem width of long shoot (mm) |
| 6. | Stem hairs absent (0) sparse (1) moderately dense (2) or dense (3) |
| 7. | Leaves per centimetre |
| 8. | Leaf length (mm) |
| 9. | Leaf width at midpoint (mm) |
| 10. | Leaf width at base (mm) |
| 11. | Average number of visible leaf veins |
| 12. | Total length of perianth and hypanthium (mm) |
| 13. | Hypanthium length (mm) |
| 14. | Style length (mm) |
| 15. | Filament length (mm) |
| 16. | Gland scale diameter (mm) |
| 17. | Hypanthium hairy on inside (0) or not (1) |
| 18. | Vegetative buds in inflorescence (0) or inflorescence terminal (1) |
| 19. | Seed length (mm) |
| 20. | Seed width (mm) |
| 21. | Average number of flowers in the inflorescence |
| 22. | Gland scales 8 distinct (0) 8 closely paired (1) 4 notched (2) 4 round (3) |
| 23. | Leaf length / leaf width at midpoint |
| 24. | Leaf base width / leaf width at midpoint |
| 25. | Total perianth and hypanthium length / hypanthium length |
| 26. | Leaves per centimetre / leaf length |

Of the 96 specimens scored, nine were *K. laxa* from the Bogong High Plains, 26 were *K. laxa* from New Zealand, eight were *K. dieffenbachii* from New South Wales, 16 were *K. dieffenbachii* from Tasmania, and 37 were *K. dieffenbachii* from New Zealand (employing current identification status). The groups were inevitably of unequal sizes as very few collections have been made from the small populations in Victoria and New South Wales. Much larger samples were utilised for the New Zealand groups to adequately cover the more extensive geographic, ecological and morphological ranges of the species there.

Multivariate analysis was carried out with the PATN package (Belbin 1995), employing agglomerative hierarchical clustering (Unweighted Pair Group Method of Arithmentic averaging – UPGMA) to produce a dendrogram, Semi-Strong Hybrid Multidimensional Scaling to produce an ordination and Kruskal-Wallis values to indicate the importance of each character in the separation of major groups.

An initial analysis was carried out on the full data set of 96 collections scored for 26 characters. In a second analysis of 95 collections scored for 26 characters, an outlier (AK 58357) was omitted. Kruskal-Wallis values were calculated for the set of collections included in the second analysis. A third analysis assessed the effect of character 18 (presence of vegetative buds in the inflorescence), by omitting it from the data matrix, which thus comprised 96 collections scored for 25 characters.

Scanning Electron Micrographs were prepared from fresh material cultivated at the Royal Botanic Gardens Melbourne. Specimens were dissected then fixed in 2.5% glutaraldehyde in 0.1 M phosphate buffer, post-fixed in 1% $OsO_4$ then dehydrated through a series of acetone solutions. Specimens were critical-point dried in a Tousimis Samdri pvt-3 then mounted on stubs and sputter-coated with gold in an Edwards Sputter Coater S150B. Stubs were then viewed under a X1-30 Philips Scanning Electron Microscope.

## Results and further analysis

In the initial analysis, there were two main groups in the dendrogram (Fig. 1). One of these is divided further into two clear subgroups: one composed of specimens of *Kelleria laxa* from the Bogong High Plains (Group A, hereafter referred to as '*K. laxa* Bogong'), and one of *K. laxa* from New Zealand (Group B — '*K. laxa* NZ'). There is one aberrant specimen of *K. laxa* from the Lammerlaw Range, Otago, New Zealand (CHR 417905, labelled 'X' in Fig. 1) that clusters with the Victorian population. All specimens of *K. dieffenbachii* are placed in the second major group (Group C). The *K. dieffenbachii* specimens are divided into three subgroups, two of these large (C1 and C2), and the third a single outlier specimen, AK 58357, from Tongariro, North Island, New Zealand. These subgroups show no correlation with geographic distribution, as specimens from New South Wales, Tasmania and New Zealand are scattered throughout C1 and C2 (Fig. 1).

The outlier AK 58357 (labelled 'Y' in Fig. 1), a New Zealand specimen of *K. dieffenbachii*, compressed the spread of all other specimens in the initial ordination. It was a depauperate specimen, lacking flowers and seeds, so it was removed from the data set and the ordination re-run. The ordination pattern from the second analysis confirms the presence of three main groups, *K. laxa* Bogong, *K. laxa* NZ and *K. dieffenbachii* (Fig. 2). All *K. laxa* Bogong specimens formed a coherent group. The one New Zealand specimen (CHR 417905) that had grouped with the Bogong specimens in the initial dendrogram no longer groups with them and the significance of its placement in that group is equivocal.

**Figure 1.** Dendrogram produced from analysis of 96 specimens of *Kelleria* scored for 26 characters. 'X' indicates specimen CHR 417905; 'Y' denotes AK 58357.

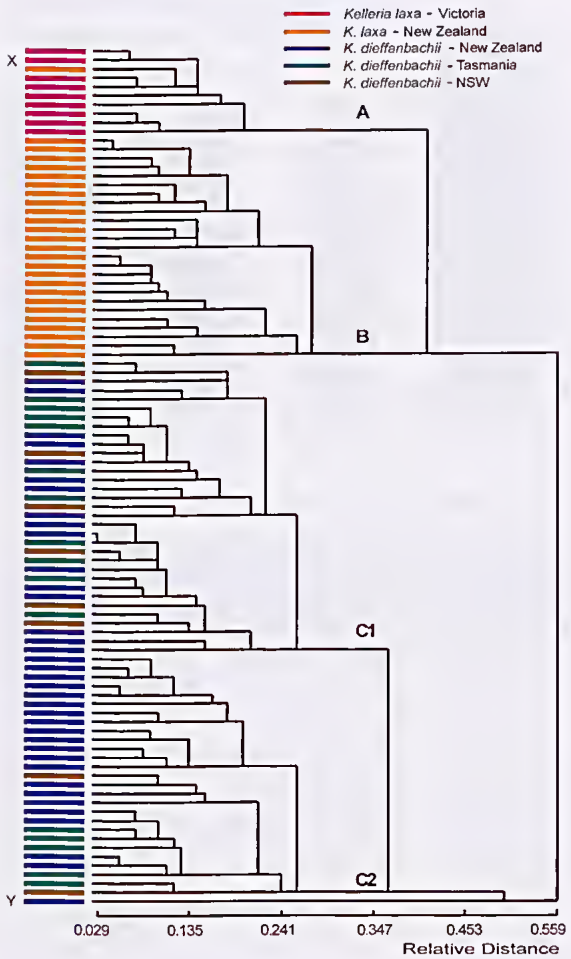
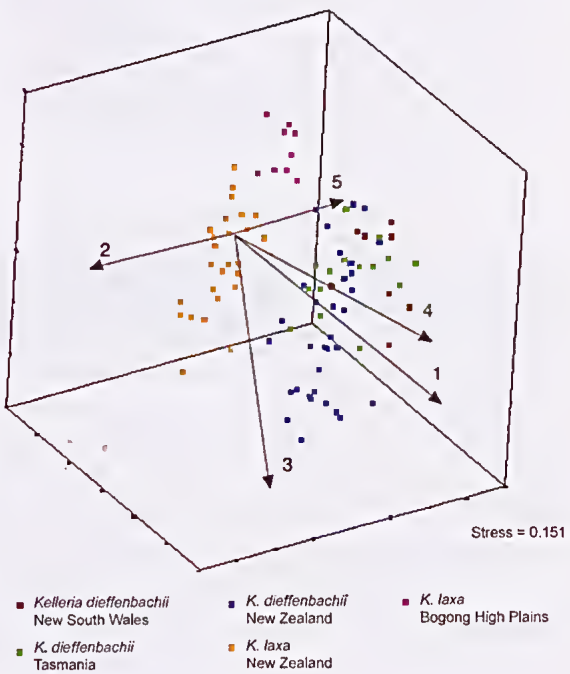



**Figure 2.** Three-dimensional ordination of specimens scored in morphological study, omitting one outlier. Vectors of the five most important characters that correlate with the ordination pattern are shown. 1: presence of vegetative buds in inflorescence; 2: leaf width at midpoint; 3: total perianth length; 4: ratio of leaf base width to leaf mid-width; 5: leaves present on long shoot.



All *K. dieffenbachii* specimens form a group with New South Wales, Tasmanian and New Zealand specimens scattered throughout, however the lower end of the group contains only New Zealand specimens.

Vectors of the five most important characters that correlate with the ordination pattern (Fig. 2) indicate that the most critical differentiating character is the presence of vegetative buds in the inflorescence, which all *K. laxa* possess and all *K. dieffenbachii* lack. The second vector, leaf width at midpoint, distinguishes the *K. laxa* New Zealand group from the others. The hypanthium and perianth length vectors distinguish both the *K. dieffenbachii* group and the *K. laxa* NZ group from the Bogong group. There is a subgroup of *K. dieffenbachii* apparent in the dendrogram (Fig. 1, as part of C2) and also in the ordination (Fig. 2) that comprises only New Zealand specimens. This subgroup is particularly distinguished by flower size, which suggests the presence of larger flowers in this subgroup is what separates it from the other *K. dieffenbachii* specimens. The leaf base width/leaf mid-width vector, like the vegetative buds vector, separates *K. laxa* from *K. dieffenbachii*. The vector 'leaves present on the long shoot or not' also distinguishes *K. laxa* NZ from the *K. dieffenbachii* group.

Kruskal-Wallis values (Table 2) indicate that the most important character in separating the three major groups apparent in the dendrogram and ordination was the presence of vegetative buds in the inflorescence, followed by three leaf dimension characters and the number of leaf veins. Typical leaf shapes based on mean values graphically summarise the differences in shape between the groups (Fig. 3). *Kelleria laxa* NZ has the largest leaves of all the groups and they are distinctly elliptic. Leaves of *K. dieffenbachii* are more linear and have on average three leaf veins compared to five. Leaves of *K. laxa* Bogong are the smallest of all the groups and are similar in shape and venation to *K. dieffenbachii* but are slightly more narrowed towards the base.

**Figure 3.** Average leaves of species of *Kelleria* in this study. Leaf proportions calculated from mean values for leaf length, width at base, width at midpoint and number of veins from all individuals included in the study for each species. **a.** *K. laxa* New Zealand; **b.** *K. laxa* Bogong High Plains; **c1 and c2.** *K. dieffenbachii*. Groups taken from multivariate analyses shown in Figs 1 and 2.

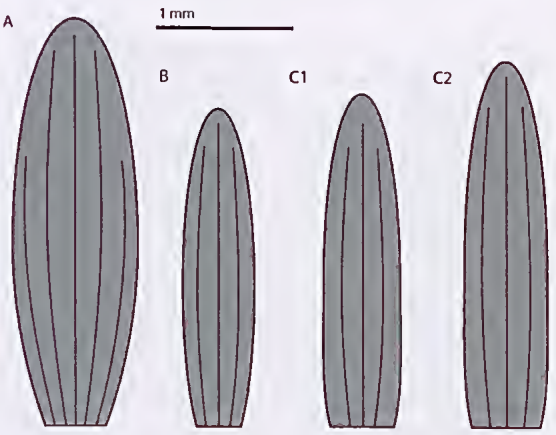



**Table 2.** Kruskal-Wallis values for the five most important characters for separating the three major groups identified in Fig. 1

| Character | Kruskal-Wallis value | Group A "Bogong" | Group B *K. laxa* New Zealand | Group C *K. dieffenbachii* |
|---|---|---|---|---|
| | | x ± sd (range) | x ± sd (range) | x ± sd (range) |
| 18. Vegetative buds in inflorescence (0) or inflorescence terminal (1) | 88.07 | 0 (buds present) | 0 (buds present) | 1 (buds absent) |
| 24. Leaf base width / leaf width at midpoint | 64.13 | 0.64 ±0.084 (0.48 – 0.77) | 0.50 ±0.084 (0.35 – 0.67) | 0.84 ±0.11 (0.48 – 1.14) |
| 9. Leaf width at midpoint (mm) | 56.60 | 0.49 ±0.055 (0.41 – 0.60) | 0.86 ±0.13 (0.70 – 1.20) | 0.54 ±0.073 (0.41 – 0.76) |
| 23. Leaf length / leaf width at midpoint | 43.56 | 4.5 ±0.46 (4.0 – 5.2) | 3.3 ±0.50 (2.4 – 4.2) | 4.5 ±0.62 (3.2 – 6.2) |
| 11. Average number of visible leaf veins | 36.55 | 3.0 ±0.00 (3 – 3) | 4.0 ±0.94 (3 – 5) | 2.9 ±0.57 (1 – 5) |

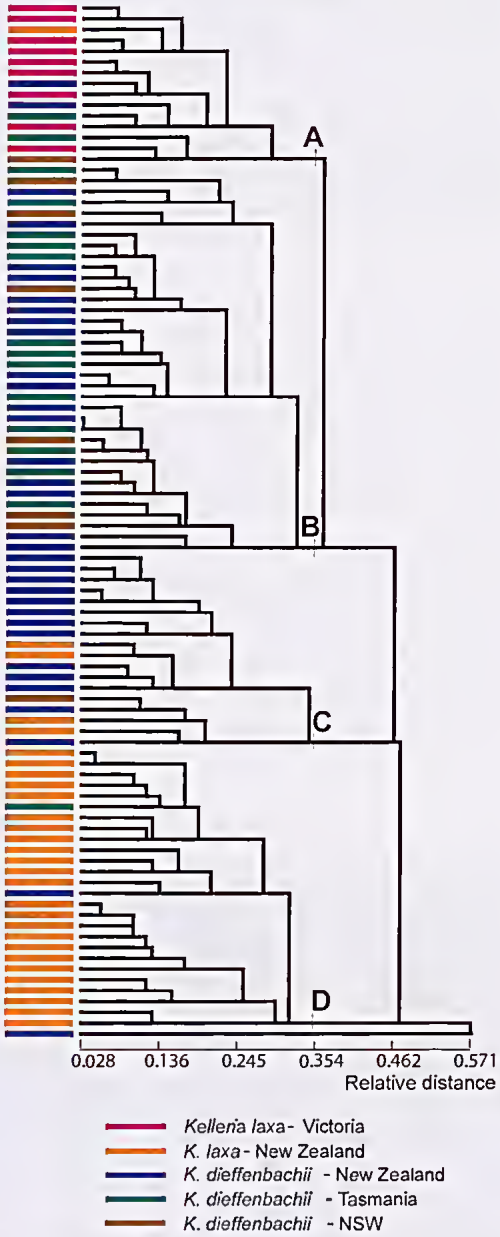
To test whether the binary character 'presence of vegetative buds in the inflorescence' (character 18) might have been masking the influence of some other characters, the agglomerative hierarchical analysis was re-run without this character. The groups in the dendrogram still mainly hold together (Fig. 4) with New Zealand *K. laxa* being most distantly separated from Bogong specimens rather than being nearest as in the initial classification. Group A comprises mostly Bogong specimens and Group B incorporates New South Wales, Tasmanian and New Zealand *K. dieffenbachii*. Group C is mostly New Zealand *K. dieffenbachii* and Group D is mostly New Zealand *K. laxa*. It is interesting to note that without this key character, the Bogong group is more closely linked to the *K. dieffenbachii* group that contains the other Australian specimens rather than to New Zealand plants of either species, and of these, it is most remotely linked to *K. laxa*.

## Taxonomic implications

***Kelleria dieffenbachii:*** On morphological evidence *Kelleria dieffenbachii* was found to be a distinct taxon. All *K. dieffenbachii* specimens grouped together in the multivariate analyses and there was no significant separation of specimens from distinctly different geographic regions, i.e. Tasmania, New South Wales and New Zealand, that suggested distinct taxonomic recognition was warranted.

***Kelleria laxa:*** In the multivariate analyses, specimens were placed into two distinct groups – the Bogong group and the New Zealand group. Leaf size, leaf shape and flower size were important characters that separated them. The most important character shared by both groups in separating them from *K. dieffenbachii* was the presence of vegetative buds in the inflorescence. When this character was removed from the data set, the groups still largely held together, however the Bogong group aligned more closely with the *K. dieffenbachii* group in the classification. The presence of vegetative buds in the inflorescence changes the growth pattern and thus the architecture of the plant. *Kelleria dieffenbachii* plants have a clear long shoot/short shoot morphology where orthotropic short shoots, each bearing a terminal inflorescence, are borne on a plagiotropic runner that also produces adventitious roots. *Kelleria laxa* also has a long shoot/short shoot morphology, but one that is

**Figure 4.** Dendrogram produced as in Fig.1, but with character 18 removed




modified when the vegetative buds grow through the inflorescences. Heads (1990b) argued that the growth habit of *K. laxa* is of a form close to the boundary between monopodial and sympodial development. Vegetative buds are also produced in the inflorescence of the New Zealand species *K. lyallii*, *K. paludosa* and very occasionally *K. multiflora* (Heads 1990b).

There is a continuum of architectural modifications in *Kelleria* and *Drapetes* including suppression of

**Key to *Kelleria* species investigated in this study**

1 Vegetative buds in inflorescence absent, inflorescence terminal; ovary glabrous in Australian plants (glabrous or pilose in New Zealand) ..... ***K. dieffenbachii***

1: Vegetative buds in inflorescence present; ovary pilose towards apex ..... 2

2 Leaves distinctly elliptic, mostly 5-nerved; leaves on short shoots 2.2–4.3 mm long, 0.5–1.2 mm wide; (2–)3–5 flowers per inflorescence; New Zealand ..... ***K. laxa***

2: Leaves ± oblong, parallel sided for most of length, 1–3-nerved; leaves on short shoots 1.9–2.5 mm long, 0.4–0.6 mm wide; (1–)2(–3) flowers per inflorescence; mainland Australia ..... ***K. bogongensis***

adventitious roots along the runner and suppression of the runner itself (Heads 1990b). In fact, the genus *Kelleria* displays a range of growth habits from cushions to loose mats or erect shrubs. The presence of vegetative buds in both New Zealand and Bogong *K. laxa* may be the result of parallel evolution, in which case *K. laxa*, as currently described, would be a polyphyletic taxon. Alternatively, this trait may have arisen once, in which case *K. laxa* Bogong and *K. laxa* New Zealand would be sister groups. A wider study of the entire genus should suggest which of these two explanations is more likely. Heads's (1990b) diagram of phylogenetic affinities among species of *Kelleria* does not depict *K. laxa* and *K. dieffenbachii* as particularly closely related within the genus.

Based on the morphological evidence, which clearly separates *K. laxa* Bogong and *K. laxa* NZ, we propose that *K. laxa* Bogong be treated as a distinct species.

## Taxonomy

### *Kelleria bogongensis* Marks sp. nov.

***Type:*** **AUSTRALIA, VICTORIA.** Alpine National Park, Bogong High Plains, 0.5 km west of Mt Jim, January 1980, *R. Adair 893* (holo: MEL 577528; iso: HO 38668).

Creeping, mat-forming, soft subshrub. Stems of short shoots to 0.8 mm diameter, sparsely pubescent, especially around leaf bases, or glabrous. Leaves glaucous to grey-green, oblong to very narrowly elliptic, slightly narrowed at base, those of short shoots 1.9–2.5 mm long, 0.4–0.6 mm wide, those of long shoots up to 4.0 mm long, 1- or 3-nerved, the lateral 2 nerves (when apparent) much finer than midrib, margins slightly incurved, sparsely ciliate distally, apex obtuse, with a tuft of straight, curved or flexuose hairs sometimes extending slightly abaxially down midrib; leaves usually glabrescent with age. Bracts not differentiated from leaves, or slightly wider (to c. 0.7 mm wide). Inflorescence of 1–3 flowers (usually 2), with 1 or 2 central vegetative buds finally growing out. Flowers bisexual. Perianth 2.5–3 mm long, cream; hypanthium 1.3–2.2 mm long; tepals 4, triangular, 0.7–1.5 mm long, outer surface evenly covered with antrorse, simple hairs, usually with a few simple hairs on inner surface of tube; gland scales 8, inserted at summit of hypanthium, 0.07–0.1 mm diameter; stamens alternating with tepals, filaments 0.1–0.6 mm long; ovary narrowly ovoid, slightly shorter than hypanthium, sericeous toward apex; style 0.6–0.9 mm long, stigma papillose. Achene obliquely ovoid, 2.0–2.3 mm long, 1.0–1.1 mm wide, pilose toward apex, brown. Seed black, glossy; 1.9–2.2 mm long, 0.95–1.0 mm wide. (Figs 5, 6)

***Other specimens examined:*** **VICTORIA.** Bogong High Plains, 1.0–1.5 km NNE of Mt Jim, 29.xii.1991, *R.J. Adair s.n.* (MEL); Bogong High Plains, 1.2 km due N of Mt Jim, 10.i.1992, *N.G. Walsh 3287* (MEL); Bogong High Plains, 300 m NW from Mt Jim summit, 13.i.2000, *N.G. Walsh 5173* (MEL); Bogong High Plains, c. 1.5 km N from Mt Jim, 3.iv.2006, *N.G. Walsh 6419 & J.P. Walsh* (K, MEL).

***Distribution:*** Confined to a single population near Mt Jim, Bogong High Plains, north-eastern Victoria. On current knowledge, the population consists of eighteen patches, varying in size from c. 0.1 $m^2$ to c. 5 $m^2$, within an area of ca. 1.5 × 0.5 km.

***Habitat:*** *Kelleria bogongensis* occurs in alpine grassland dominated by *Poa costiniana* Vick. on shallow organic loams overlaying basalt (Tertiary Older Volcanics). Plants form discontinuous mats on the edges of seasonally inundated pools, or between *Poa* tussocks, nearly always in association with *Argyrotegium nitidulum* (Hook.f.) J.M.Ward & Breitw. and *Lobelia surrepens* Hook.f.

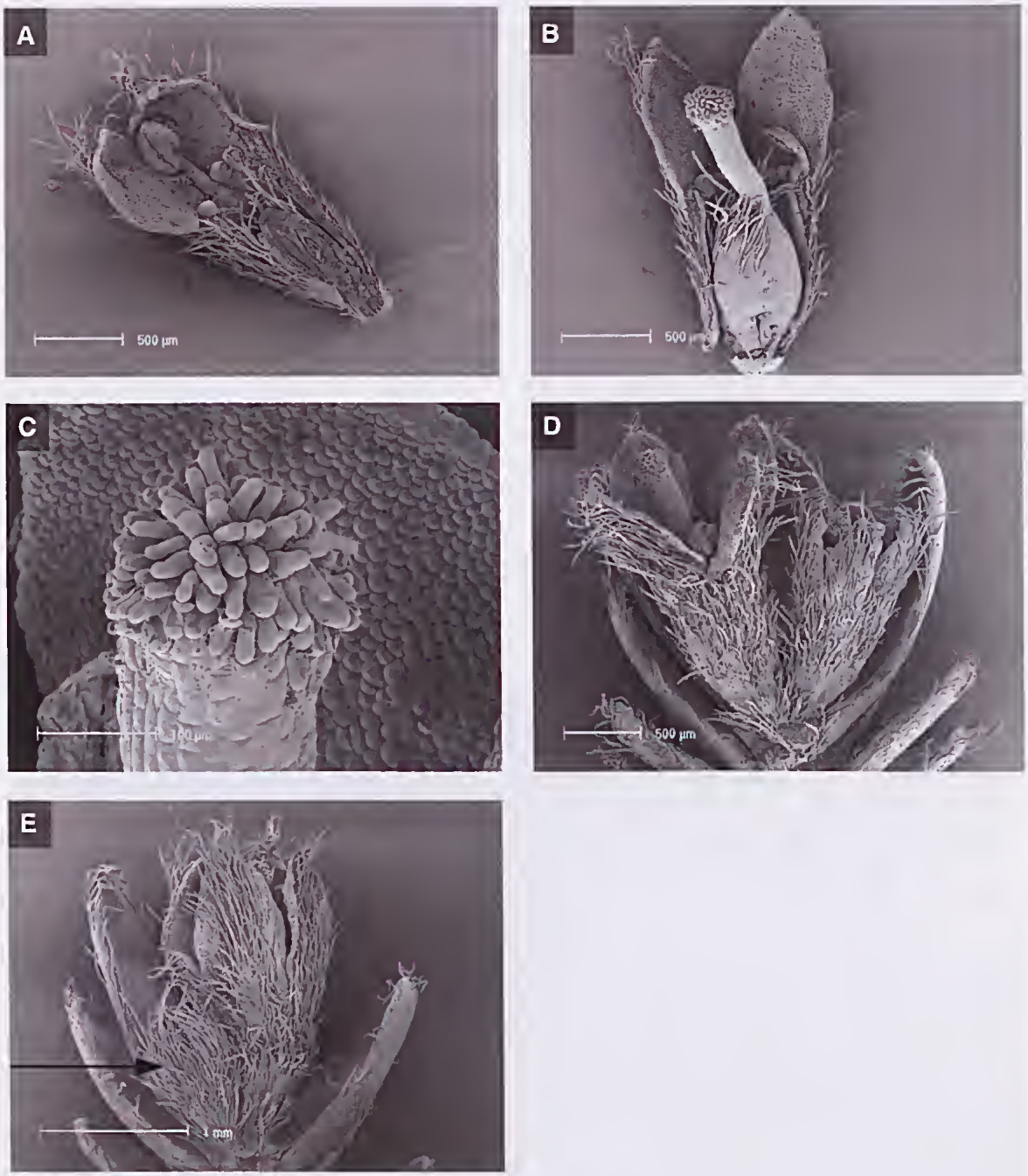
***Conservation status:*** Listed as Threatened under the Victorian Flora and Fauna Guarantee Act 1988 and considered to be Vulnerable under the Federal Environment Protection and Biodiversity Act 1999 (both as *Kelleria laxa*), and recognised as endangered in Victoria (Walsh & Stajsic 2007, as *K. laxa*). Applying IUCN (2001) criteria, it is assessed as Critically Endangered (CR) due to its extremely limited area of occupancy and susceptibility to habitat loss as a consequence of a warming climate. All populations are contained within the Alpine National Park.

Data collected in the course of this study (Marks, unpubl.) indicated that there was a significant decline in cover of *K. bogongensis* between 1993, when permanent study plots were established, and 2002. These dates encompassed a period of extended drought that culminated in the disastrous alpine fires of January 2003, which fortunately did not directly affect the *Kelleria* population. Prior to those fires, cattle grazed the Bogong High Plains over summer, potentially posing a further threat to the *Kelleria* population; but since 2003 cattle grazing has been withdrawn from the Alpine National Park. However, in recent years, there has been a marked increase in the number of wild horses in the vicinity of Mt Jim where there is now a resident population in excess of 20 animals posing a significant threat through grazing/trampling pressures (NW pers. obs.).

***Notes:*** *Kelleria bogongensis* differs from *K. laxa* with which it has been included, primarily in the shorter, 1–3-nerved leaves and mostly 2-flowered inflorescences. It differs further in the diameter of the stems of the long shoots being less than 0.8 mm (compared to greater than 0.8 mm in *K. laxa*), and the flowers having gland scales that are less than 0.1 mm in diameter, whereas those of *K. laxa* are greater than 0.1 mm in diameter. The size of all floral structures and length of short shoots are, on average, smaller in *K. bogongensis* than in *K. laxa*. In addition to the lack of vegetative buds in the inflorescence, *K. dieffenbachii* differs from *K. bogongensis* in having (1–)4(–6) flowers per inflorescence and coarser short shoot stems. The leaves of *K. dieffenbachii* do not narrow at the base like those of *K. bogongensis*. Plants of *K. bogongensis* and *K. dieffenbachii* (from Tasmania) grown in a glasshouse under identical conditions for eight months maintained their leaf shapes.

**Figure 5.** *Kelleria bogongensis*, field photograph, Bogong High Plains, Victoria

**Figure 6.** *Kelleria bogongensis*, scanning electron micrographs: **a.** longitudinal section through a young flower; **b.** section through an older flower showing ovary; **c.** papillose stigma; **d.** two flowers in an inflorescence, a third flower has been removed in the foreground; **e.** inflorescence with one flower removed in the foreground, arrow shows vegetative bud (from cultivated material of same collection as *Walsh 3287*)



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Muelleria

33: 13–19

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# Australian coralloid fungi IV – *Ramaria filicicola*

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## Introduction

*Ramaria gracilis* (Pers. : Fr.) Quél. is a very widely distributed taxon in the northern hemisphere with a range extending from the United States (Petersen 1975; Exeter et al. 2006) across to Europe (Breitenbach & Kranzlin 1986; Hansen & Knudsen 1997) and thence into Russia (Petersen 1975). This coralloid fungus is characterised by whitish or cream-coloured fruiting bodies that become ochraceous with age, are tufted in habit, have a somewhat tough texture, are extensively branched with acute apices, usually have a distinct odour of aniseed when fresh and mostly appear on the litter of northern hemisphere species of conifer. Rhizomorphs can be expected to be present in any collection of *R. gracilis*, and usually they are abundantly produced.

Systematically, *R. gracilis* belongs to subgenus *Lentoramaria* Corner. This subgenus contains species of *Ramaria* (Fr.) Bonord. in which the walls of the hyphae become extensively thickened. Two distinct types of hyphae can be produced which are called skeletal hyphae and secondarily skeletalised hyphae (Petersen 1988). Skeletal hyphae are typically quite narrow in diameter (2–4 µm), have an extremely fine, hair-like lumen, are without branches, do not have clamps except at their commencement, and often have lengths of 100–200 µm or occasionally longer. Secondarily skeletalised hyphae can be visualised as normal hyphae in which the cell wall has become much thicker than normal. These hyphae can be branched and/or clamped and usually have a rather rough or uneven outline when compared with a normal generative hypha.

*Ramaria gracilis* belongs to a section of *Lentoramaria* in which skeletal hyphae are found abundantly in the rhizomorphs and additionally

## Abstract

A large number of Australian collections that would routinely be assigned to *Ramaria gracilis* (Pers. : Fr.) Quél. have been examined together with authentic material of that species from both Sweden and the United Kingdom. This has confirmed that the European and Australian taxa are separate species and that *R. gracilis* as known in Europe does not occur in Australia. The type collection of *Ramaria filicicola* (S.G.M.Fawc.) Corner has been examined and all Australian collections previously identified as *R. gracilis* are now considered to be identical to *R. filicicola*. An updated description for *R. filicicola* is here provided together with a colour image of this Australian taxon. *Ramaria filicicola* is now considered to be a widespread Australian species which also occurs in New Zealand.

***Key words***: fungi, systematics, *gracilis*, Australia

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penetrate upwards into the stipe and at least the lower branches. These tissues are therefore dimitic and they may also contain secondarily skeletalised hyphae. Corner (1970) erroneously stated that the skeletal hyphae in *R. gracilis* were restricted to the rhizomorphs, however Petersen (1975, 1988) found that skeletal hyphae are present in the fruiting body itself and this is also confirmed by Hansen and Knudsen (1997).

Most Australian records of a 'whitish to buff' coralloid taxon identify the species as *Ramaria gracilis*. At least some of these records have noted that the Australian species so identified differed in some ways from the European species, but these differences were apparently dismissed as minor because the whole 'raft of characteristics' seemed to fit *R. gracilis* much more closely than anything else. Fuhrer (2005) published an image and a short description of a coralloid fungus which he identified as *R. gracilis*, and the current situation seems to be that if the fungus is whitish, tufted, has acute apices and is on forest litter, then it must be *R. gracilis*.

Difficulties arise however, when another species, *Ramaria filicicola* (S.G.M.Fawc.) Corner (= *Clavaria filicicola* S.G.M.Fawc.), is considered. *Ramaria filicicola* is remarkably similar to *R. gracilis* and, as its name suggests, was found in association with tree-ferns and/or their associated litter. Australian material describing *R. filicicola* has rarely been published apart from the original type description of Fawcett (1940), and it seems to have been separated from *R. gracilis* largely on the basis of the preference for tree-fern debris (Fawcett 1940; Willis 1958). Species separation purely on the single criterion of substrate is, in the author's opinion, unsatisfactory. However, this situation has recently become even more untenable because Fuhrer (2005) indicated that what he considered to be *R. filicicola* is capable of exploiting both forest and tree-fern litter.

This paper therefore has two aims. First, to ascertain whether the Australian species designated as *R. gracilis* is actually identical to the European taxon. Second, and as a consequence, to compare collections of Australian material and determine if the separation of the two Australian taxa identified as *R. gracilis* and *R. filicicola* is supported, or whether they are in fact the same species.

## Some records of *Ramaria gracilis* in Australia

There do not seem to be any records indicating the presence of *Ramaria gracilis* in Australia prior to 1913. No mention of the species is to be found in the lists of Cooke (1892), McAlpine (1895) or Bailey (1913) and the first reliable description, with available herbarium records, appears to be that of Cleland (1935) who recorded a coralloid fungus he believed to be *Clavaria gracilis* Pers. : Fr. from South Australia, where he found it growing in tufts on *Pinus radiata* D.Don litter. Cleland noted that it had a pale buffy tint, acute apices, was extensively branched, and often had sheets of mycelium at the base. He also described its slightly tinted and irregular spores (5.5 × 3.5 µm) but did not report any details of either the rhizomorphic or tramal structures. Cleland did not record any associated odour.

Fawcett (1939) recorded what she considered to be *C. gracilis* from the Brisbane Ranges in Victoria and provided an excellent description which included the presence of rhizomorphs and a slightly fragrant odour. Like Cleland (1935), Fawcett (1939) found the species in tufts amongst the litter of an exotic species of pine, in this case *Pinus insignis* Douglas ex Loudon. Willis (1958) gave a very brief description of what he considered was *Ramaria gracilis* which included the white or clay coloured to cinnamon tints of the fungus, together with the fact that it was found 'under pines'.

Griffiths (1985) described *R. gracilis* from the Darling Scarp of Western Australia where he recorded it as occurring 'in open mossy ground beneath Peppermints'. This record is uncertain because Griffiths also stated that the spores are 'squarish-oval with prominent pore'. The spores of *R. gracilis* do not have a 'prominent pore'. Hilton (1988) listed *R. gracilis* for Western Australia but, apart from a herbarium record, provided no other details.

Fuhrer and Robinson (1992) provide an excellent colour photograph and a short description of what they consider to be *R. gracilis* as found in Tasmania. They indicate that the species is found both in eucalypt forests and pine plantations. Despite the obvious 'buff tints', the overall 'whitish' colour is very marked in the photograph provided. Fuhrer (2005) contains a photograph of a large coralloid tuft identified as *R. gracilis* which is then described as white to clay-coloured and common in both eucalypt and pine forest. Fuhrer (2005) also noted

the habit of the species to form partial or complete 'growth rings several metres in diameter'.

### Some records of *Ramaria filicicola* in Australia

*Clavaria filicicola* was first described from Victoria by Fawcett (1940) where it was found growing on the surface of tree-fern trunks (*Dicksonia antarctica* Labill.) just below the crown of leaves. Fawcett stated that it arose from a dense mycelium, that it was at first pure white and then became yellow to ochraceous buff when old, had sharply pointed apices and was without a distinct odour. The spores were described as yellowish in bulk, distinctly rough, oblong elliptical and 5.6–7 × 3.6–3.9 µm. Fawcett noted that *C. filicicola* closely resembles *C. gracilis*, but that the two species can be separated on the basis that *C. filicicola* has rougher spores, no odour and grows on tree ferns.

From the date of Fawcett's type description in 1940, there are very few published records for *Ramaria filicicola*. Corner (1950) transferred the species to *Ramaria* but simply quoted the description of Fawcett (1940). Corner considered that the species could be identical to *R. megalorhiza* (Berk. & Broome) Corner and he also noted that *R. filicicola* did not have the aniseed odour of *R. gracilis*. As well as the species *R. gracilis*, Willis (1958) also listed *R. filicicola* Corner and provided a description that emphasised the tree-fern trunk habitat as a method of identifying and separating the species from *R. gracilis*. Apart from the habitat separation, Willis's brief descriptions of both species are remarkably similar and would not serve to definitively separate the two taxa.

The last known published record for *R. filicicola* is that of Fuhrer (2005) where the photograph of the species shows it to be growing amongst forest litter with a fern component. Fuhrer indicated that the species was to be found amongst forest litter, but particularly decaying tree-fern debris.

### Materials and methods

Forty-five collections were examined during the production of this paper and the material was sourced from the following herbaria: BRI, UNSW, MELU, MEL, HO, AD, PERTH, TENN and USO. A representative sample of 20 of those collections is presented under 'Selected specimens examined'. Specimen samples were examined under an Olympus CX40 research light microscope (with drawing tube) using both ammoniated congo red and cotton blue in lactic acid as the mountants. Congo red was the preferred initial stain for all tissues, while cotton blue (with the sample pre-heated for a few seconds in the mountant) was used to provide accurate observations of the spore wall and its structures. Q values are omitted for the basidia because, like most species of *Ramaria* so far encountered, the basidial lengths appear to vary considerably with both fruiting body maturity and even the sampling location on the fruiting body. The basidial mean should also be accepted with some caution. The distribution chart was developed using DMAP (Morton 2005). Colour chip references are not yet available for this taxon.

## Discussion

*Ramaria gracilis* is defined as having both dimitic rhizomorphs and basidiomata: skeletal hyphae occur in the rhizomorphs, the stipe and usually in at least the lower branches of the fruiting body (Marr & Stuntz 1973; Petersen 1975; Hansen & Knudsen 1997; Franchi & Marchetti 2001). Whilst the Petersen neotype (L 910.262–1000, Petersen 1975) has not been seen (it can safely be assumed to conform precisely with Petersen's dimitic concepts), two collections of European material of *R. gracilis* from Norfolk, UK (USO 295806) and Drottningholm, Sweden (USO 333207) have been examined. Both of these collections (the first of which was collected by E.J.H. Corner himself) were identified by Corner as *R. gracilis* and each confirms the dimitic concepts presented by the above authors: skeletal hyphae were found to be present in the rhizomorphs and also running through the stipe trama and into the branch trama of the fruiting bodies. Corner (1970) erroneously indicated that skeletal hyphae were only to be found in the rhizomorphs/mycelium of *R. gracilis*, however the written and personal observational evidence provided above overwhelmingly shows that Corner was mistaken in his conclusions and that skeletal hyphae are to be found not only in the rhizomorphs of *R. gracilis* but also in the main parts of the fruiting body itself. This dimitic status of *R. gracilis* has also been confirmed by the examination of a relevant Canadian collection made by R.F. Cain (USO 295807).

Throughout this investigation, no collections of Australian material (originally assigned to either *R. gracilis* or *R. filicicola*) have demonstrated the presence of skeletal hyphae anywhere else other than in the rhizomorphs and thus both species as currently understood in Australia, are identical in this structural aspect. The presence or absence of secondarily skeletalised generative hyphae is rather more variable, but the overall circumstances are similar for Australian material that has been originally assigned to either species. Some collections assigned to either species have very few of these secondarily skeletalised hyphae which may be confined to the rhizomorphs only. In other collections, secondarily skeletalised generative hyphae may be found generally throughout the basidioma and this variable situation produced the comment by Petersen (1975) in which he indicated a Cleland collection totally lacked skeletalised generative hyphae. Petersen (1988) indicated that New Zealand material of *R. filicicola* consistently displayed skeletalised hyphae in the branch trama whereas in Australian material assigned to either *R. gracilis* or *R. filicicola*, the presence of skeletalised hyphae was less common.

No collection of either species, as found in Australia, is recorded as displaying a distinctive scent of aniseed. Cleland (1935) did not record any odour for *R. gracilis*, Fawcett (1939) indicated that *R. gracilis* had a slightly fragrant odour, and Fawcett (1940) indicated that *R. filicicola* was odourless. My own field observations indicate that there is only a slight 'medicinal' or 'fungousy' odour in any collection previously assigned to *R. gracilis* – there is never a strong aroma of aniseed. It is highly unlikely that other field workers would not have recognised such an aroma (if present) and recorded it, and on this basis it is confidently asserted that the aniseed odour is absent from Australian material that has been identified as either *R. gracilis* or *R. filicicola*.

## Conclusions

There is no doubt that Australian collections assigned to *Ramaria gracilis* are very similar in macroscopic characters to the recognised European taxon, however the Australian collections differ in microstructure and almost certainly in some biochemical pathways as the absence of the aniseed odour demonstrates. For these reasons, the Australian species is no longer considered to be *R. gracilis* but is a separate taxon. Petersen (1975) reached the same conclusion but was reluctant to make any changes because he had seen very little material. In a later publication, Petersen (1988) rejected the concept of *R. gracilis* for New Zealand material and placed all such collections under the name of *R. filicicola*.

The observations which form the basis of this present research also confirm that there are no discernible differences between the Australian material previously assigned to the European species *R. gracilis*, and material of the Australian species *R. filicicola*, apart from the normal macroscopic variations that can be expected under different habitat conditions. For all the above reasons, the name of *R. gracilis* is rejected for Australian material which is now identified as the single species *R. filicicola*.

## Taxonomy

***Ramaria filicicola*** (S.G.M.Fawc.) Corner, *Ann. Bot. Mem.* 1: 576 (1950)

*Clavaria filicicola* S.G.M.Fawc., *Proc. Roy. Soc. Victoria,* n.ser. 52: 155 (1940). *Type:* Victoria, Turtons Pass, May 1935, *S.G.M.Fawcett s.n.* (holo: MELU 7036F!)

*Clavaria gracilis sensu* Cleland, *Toadstools and Mushrooms and Other Larger Fungi of South Australia* part 2: 266 (1935) and *sensu* Fawcett, *Proc. Roy. Soc. Victoria, n. ser.* 51: 17 (1939) *non* Pers. : Fr.

*Ramaria gracilis Victorian Naturalist* 74: 131 (1958) and *sensu* Fuhrer, *A field guide to Australian fungi*: 211 (2005) *non* (Pers. : Fr.) Quél.

*Clavaria crispula sensu* Fawcett, *Proc. Roy. Soc. Victoria, n. ser.* 51: 16 (1939) *non* Fr. : Fr.

*Ramaria crispula sensu* J.H.Willis, *Victorian Naturalist* 74: 131 (1958) *non* (Fr. : Fr.) Quél.

*Clavaria stricta sensu* Fawcett, *Proc. Roy. Soc. Victoria, n. ser.* 51: 17 (1939) *non* Pers. : Fr.

*Basidiomata* ~6 cm diam. and ~10 cm high; overall shape oboconical; *apices* dull white, tapered and awl-shaped, often dichotomous, dry; *branches* whitish to pale pinkish buff and then becoming buff-brown and more brownish as patches of basidiospores mature, cylindrical although sometimes flattened and usually very distinctly flattened near the axils, smooth but with scattered rough patches, vertically oriented; *axils* usually round but there may be

occasional acute axils present; *stipe* 1–2 cm long and up to 0.5 cm diam., single, pale buff, smooth but with scattered rough patches, aborted branches absent. *Flesh* white, colour changes absent. *Odour* slightly fragrant to medicinal or absent; *taste* not recorded. *Rhizomorphs* present and usually abundant. *Basidiospores* (5.0–)5.8–7.2 × 3.2–4.3 µm, mean 6.3 × 3.8 µm, Q: 1.5–2.0, mean Q: 1.67, ellipsoid, occasionally uniguttulate but mostly granular, hilar appendage prominent and truncate, ornamentation of scattered warts and small ridges, spore wall and warts strongly cyanophilic in cotton blue; *basidia* 32–47 × 5.4–7.8 µm, mean 38.9 × 6.7 µm, 4-spored, clamped; *sterigmata* up to 8 µm long, distinctly long-conical, straight; *branch trama* monomitic, composed of thin-walled, clamped, sometimes inflated hyphae 3.5–14 µm diam., with or without scattered to abundant secondarily skeletalised generative hyphae 3–8 µm diam. which commence or end in a clamp connection or sometimes an ampulliform swelling, ampuliform septa present and common, skeletal and gloeoplerous hyphae absent; *stipe trama* monomitic and similar to branch trama except that ampulliform septa are abundant; skeletal hyphae are sometimes invasively present in the stipe trama immediately adjacent to the mycelium, but they do not penetrate any distance up the stipe; *ampulliform septa*, –16 µm diam., often with delicate stalactitic ornamentation present; *rhizomorphic trama* dimitic, generative hyphae similar to stipe trama but with abundant skeletal hyphae 1.5–2.5 µm diam. and often with secondarily skeletalised generative hyphae. (Figs 1, 2)

***Macrochemical reactions:*** Not yet known for Australian material however Petersen (1988) states that New Zealand material becomes a deep slate-green when tested with a 10% aqueous solution of ferric chloride.

***Habit:*** Basidiomata emerging from mycelial mats (in or under litter on soil or in tree-fern debris) which are

**Figure 1.** *Ramaria filicicola* from Queensland showing rhizomorphs, © A.M.Young

**Figure 2.** *Ramaria filicicola*. **a.** basidiospores; **b.** basidium; **c.** ampulliform septum; **d.** secondarily skeletalised hypha; e. skeletal hypha. Scale bars = 10 µm

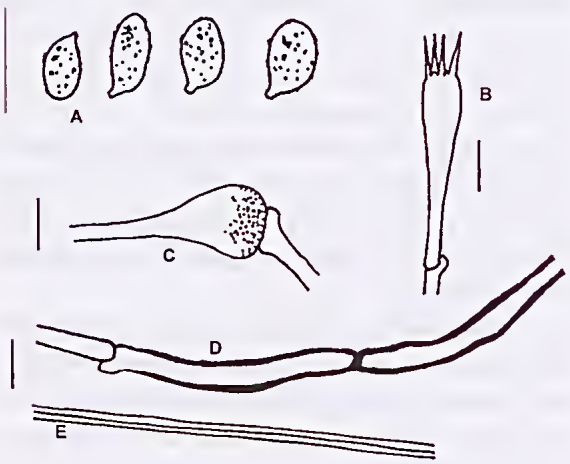
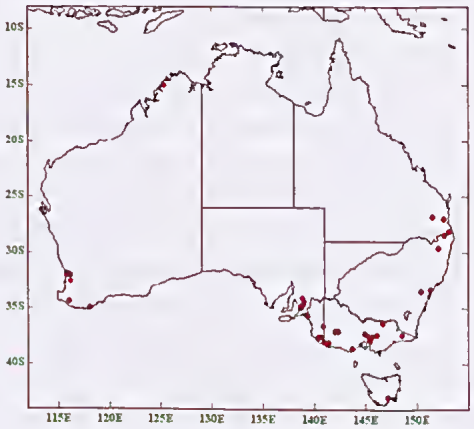



**Figure 3.** *Ramaria filicicola*. Map showing currently known Australian distribution




particularly noticeable when occurring in forests of *Pinus* spp., gregarious and may form 'fairy rings'.

***Habitat:*** May occur in tree-fern areas (especially *Dicksonia antarctica*), but mostly found in forest or woodland; frequent in forests of *Pinus* spp. and also in mixed forest or woodland containing *Eucalyptus* and/or *Acacia* spp.

***Notes:*** Fawcett (1940) described the type habitat of *Ramaria filicicola* as the 'trunks of *Dicksonia antarctica*, usually immediately below the crown of leaves'. Unfortunately, her description thus led to the situation in which the species was considered to be more or less restricted to tree-fern material. Herbarium records indicate that Fawcett's tree-fern substrate appears to be more 'unusual than normal' when it is compared with the remainder of the recorded substrates frequented by *R. filicicola*. Collection notes available to this study suggest that the species is almost always found on ground litter (with or without a tree-fern component) and that the litter may be derived from either native or exotic trees.

*Ramaria filicicola* is now known to be widespread across southern Australia with its range extending into south-east Queensland, and there is a single collection from the Kimberley region of Western Australia (Fig. 3). It also occurs in New Zealand. The wide range of this taxon and its presence in native eucalypt forests indicate that the species is indigenous to the Australian region and was not introduced accidentally with species of *Pinus* or other exotics. Records indicate that 'fairy rings' can be formed in both native eucalypt/acacia forests and exotic pine forests.

***Selected specimens examined:*** **QUEENSLAND.** Lamington National Park, 11.iii.1997, *A.M.Young 1921*, (BRI, AQ603862); Mount Mee, 26.v.2005, *A.M. Young & N.A. Fechner s.n.*, (BRI). **NEW SOUTH WALES.** Gibraltar Range National Park, 22.vi.2006, *N.A. Fechner & A.M. Young s.n.*, (BRI); Richmond Range State Forest, 10.iii.1983, *J.J. Bruhl s.n.*, (UNSW B3/168); Mount Tomah, 12.iv.1975, *A.M. Young 312*, (BRI, BRIP24912). **VICTORIA.** Brisbane Ranges, 14.vi.1936, *S.G.M. Fawcett s.n.*, (MELU 7109F); Narbethong, 29.vi.1976, *H.A. Morrison s.n.*, (MEL 269111, BRI). **TASMANIA.** North West Bay River, 21.iv.2005, *G. Gates & D. Ratkowsky GGDR30/2005*, (HO). **SOUTH AUSTRALIA.** Bangham, *J.B.Cleland s.n.*, (ADC 000469); Mt. Burr, ix.1965, *J.A. Simpson s.n.*, (ADC 000 470); Marsh's Swamp, 2.viii.1969, *L.D. Williams 3377*, (ADC 28710). **WESTERN AUSTRALIA.** Pemberton, 4.viii.19B1, *R.N. Hilton s.n.*, (PERTH 00947806); Cameron Forest Block, 22.vi.2004, *R.M. Robinson & R.H. Smith FC690*, (PERTH 06641202); Juniperina Creek, 14.v.1992, *K. Syme & M. Hart KS471/92*, (PERTH 05439698). **NEW ZEALAND.** Nelson, 20.iv.1983, *R.H. Petersen s.n.*, (TENN 43829).

***Specimens examined of* Ramaria gracilis: CANADA.** Cedar Mills, Peel Co. Ontario, 30.ix.1956, *R.F. Cain s.n.*, (USO 295807). **SWEDEN.** Drottningholm, 1905, *C.G. Lloyd 19125*, (USO 333207). **UNITED KINGDOM.** Brandon, Norfolk, 4.x.1946, *E.J.H. Corner 449*, (USO 295B06).

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# Muelleria

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# Studies in *Podolepis* (Asteraceae: Gnaphalieae)


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## Introduction

*Podolepis* Labill., as treated in modern floras (e.g. Everett 1992; Jeanes 1999), is a genus of 20 species confined to Australia and found in all states as well as the Northern Territory and the Australian Capital Territory (AVH 2014). All flora accounts of *Podolepis* s.l. over the last half century have followed the revision by Davis (1957), which also gives a detailed taxonomic and nomenclatural history of the genus. Only two new species, *P. monticola* R.J.F.Hend. and *P. davisiana* D.A.Cooke (Henderson 1969 and Cooke 1985, respectively), have been described since 1957. When specimens from the major Australian herbaria are examined critically, it becomes clear that Davis's revision is quite conservative and that several undescribed taxa have been overlooked and several described taxa should be reinstated. To be fair, Davis did not have access to such a wide range of excellent herbarium material that we enjoy today and type specimens were less accessible before the technology of digital imaging became available.

It is clear from the work of Davis (1957) and more recent taxonomic treatments (e.g. Henderson 1969; Beadle 1980; Cooke 1986; Stanley 1986; Everett 1992; Jeanes 1999), that the morphology of the intermediate involucral bracts is of importance in the delineation of species in *Podolepis*. This remains true in the present study, but other characters such as indumentum, leaf size and shape and capitulum size are also taken into account. Furthermore, some species are apparently habitat specific.

*Podolepis* is generally regarded as polyphyletic (e.g. Short et al. 1989; Anderberg 1991; Konishi et al. 2000) and in need of revision. Should species be removed from *Podolepis* s.l., combinations for some of them already


## Abstract

Herbarium specimens of species of *Podolepis* s. str. with ray florets longer than the capitula and a discrete intermediate involucral bract claw were examined. Particular attention was paid to specimens previously determined as *P. jaceaides* (Sims) Voss, *P. canescens* A.Cunn. ex DC. and *P. rugata* Labill. As a result, four species and two subspecies are described as new: *P. decipiens* Jeanes, *P. eremaea* Jeanes, *P. linearifolia* Jeanes, *P. remata* Jeanes, *P. rugata* subsp. *glabrata* Jeanes and *P. rugata* subsp. *trullata* Jeanes. To accommodate the observed variation, two species, *P. aristata* Benth. and *P. laevigata* Gand., are reinstated and the following new combinations made: *Podolepis aristata* subsp. *affinis* (Sond.) Jeanes, *P. aristata* subsp. *auriculata* (DC.) Jeanes, and *P. rugata* subsp. *littoralis* (G.L.Davis) Jeanes. The diagnostic characters of the relevant taxa are tabulated. Keys, distribution maps and information about cytology (where available), habitat and conservation status are presented.



*Key words: Scalia*, taxonomy, morphology, diagnostic features, threatened species



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exist in other genera. For example, initial molecular work (Konishi et al. 2000) supports the reinstatement of both *Panaetia* Cass. and *Siemssenia* Steetz at some level, and the removal of *P. kendallii* (F.Muell.) F.Muell. and *P. georgei* Diels (the latter to *Schoenia ayersii* (F.Muell.) J.M.Black; see Wilson 1992). From the molecular work (Konishi et al. 2000) and involucral bract and flower morphology, *Podolepis* s. str. likely consists only of those 18 species in the key below. This includes all 16 species in which the lamina of the intermediate involucral bracts is discrete from the claw (i.e. attached only at the apex of the claw) and the ray florets far exceed the involucral bracts. *Podolepis* s. str. also includes *P. arachnoidea* (Hook.) Druce and *P. neglecta* G.L.Davis, in which the intermediate involucral bracts are not completely discrete from the claw, as these two species appear in the same clade as those representitives of the former group included in the molecular phylogeny (Konishi et al. 2000). The species complexes *P. jaceoides* (Sims) Voss, *P. rugata* Labill., *P. aristata* Benth. and closely related species are dealt with in this paper. *Podolepis laciniata* Frood is included in the key here, but is described in Frood (2015) and is distinguished from *P. robusta* (Maiden & Betche) J.H.Willis by the longer ligules on the ray corolla. *Podolepis arachnoidea*, *P. gracilis* (Lehm.) Graham, *P. hieracioides* F.Muell., *P. longipedata* A.Cunn. ex DC., *P. monticola*, *P. neglecta* and *P. nutans* Steetz, which are also part of *Podolepis* s. str., will be dealt with at a later point.

Chromosome numbers for several species in *Podolepis* s. str. have been determined as $n$=8–12 (Turner 1967; Short 1986; Watanabe et al. 1999) and their associated vouchers are preserved at MEL. These specimens have been redetermined according to the taxonomy of the current paper and the chromosome numbers are given in the taxonomic section where available. Turner (1967) referred to a specimen (his number 5586 erroneously cited as 5584) he identified as *P. jaceoides* as having $n$=c. 30. I have examined this specimen and it is difficult to place based on the morphology of the involucral bracts. It is possibly a hybrid of uncertain parentage or may be a polyploid, which may account for the unusually high chromosome number.

## Materials and methods

This paper is based on the examination of qualitative and quantitative characters observed in herbarium specimens of *Podolepis*, in which the lamina of the intermediate involucral bracts is discrete from the claw and the ray florets far exceed the involucral bracts. Specimens from AD, BRI, CANB, DNA, HO, LY, MEL, PERTH and type specimens housed in other herbaria, which are listed in the taxonomic section, were studied. All the measurements given in the descriptions were taken from dried specimens and may differ slightly from the dimensions of living plants.

**Key to species of *Podolepis* s. str.**

1 Lamina of intermediate involucral bracts not completely discrete from the claw ..... 2
1: Lamina of intermediate involucral bracts completely discrete from claw ..... 3
2 Ligules of ray corolla well-developed and far exceeding length of involucral bracts; lamina of involucral bracts smooth (sometimes slightly wrinkled in dry specimens) ..... ***P. neglecta***
2: Ligules of ray corolla small and barely exceeding length of involucral bracts; lamina of involucral bracts deeply transversely rugose ..... ***P. arachnoidea***
3 Lamina of intermediate involucral bracts transversely rugose at least towards the apex ..... 4
3: Lamina of intermediate involucral bracts virtually smooth (sometimes slightly wrinkled in dry specimens) ..... 6
4 Lamina of intermediate involucral bracts often shorter than their claw, lamina 1–2.5 mm long; capitula <10 mm diam. ..... ***6. P. canescens***
4: Lamina of intermediate involucral bracts about as long as or longer than their claws, lamina usually 2.5–10 mm long; capitula usually >10 mm diam. except rarely in depauperate specimens ..... 5
5 Apex of involucral bracts more or less obtuse; capitula mostly 20–30 mm diam.; plant perennial ..... ***5. P. rugata***
5: Apex of involucral bracts acute to aristate; capitula mostly 10–20 mm diam.; plant annual ..... ***9. P. aristata***
6 Apex of lamina of intermediate involucral bracts acute to aristate ..... 7
6: Apex of lamina of intermediate involucral bracts retuse to obtuse ..... 16

7 Lamina of intermediate involucral bracts shorter than their claws ..... 8

7: Lamina of intermediate involucral bracts as long as or longer than their claws ..... 10

8 Lamina of intermediate involucral bracts narrow-truilate, less than twice as wide as their claws ..... 5. *P. rugata*

8: Lamina of Intermediate involucrai bracts ovate or ± triangular, more than twice as wide as their claws ..... 9

9 Lamina of intermediate involucral bracts ovate-acuminate, more or iess flat (sometimes slightly wrinkled in dry specimens); Western Australia, Northern Territory and South Australia ..... 7. *P. eremaea*

9: Lamina of intermediate involucral bracts ± triangular, usually with an adaxial bowl-like depression just above junction with the claw; 5outh Australia, north-eastern New 5outh Waies and Queensland ..... *P. longipedata*

10 Ligules of ray corolla pink or mostiy yeliow but apically tinged purpie ..... 11

10: Ligules of ray corolla only yellow ..... 12

11 Ligules of ray corolla pink; lamina of intermediate involucral bracts ovate, longer than broad, straw coloured, transparent, scarious ..... *P. gracilis*

11: Ligules of ray corolla yeilow, tinged with purple at the apex; lamina of intermediate involucral bracts transverse-elliptic, broader than long, reddish-brown, not transparent, rigid ..... *P. nutans*

12 Capitula mostly 5–10(–15) mm diam.; laminas of intermediate involucral bracts mostly 2–3(–4) mm long; plants from dry inland habitats ..... 13

12: Capitula mostiy (10–)15–30 mm diam.; laminas of intermediate involucral bracts mostly >4 mm long; plants from various habitats ..... 14

13 involucral bracts closely imbricate, hiding the claws; lamina of intermediate involucral bracts broad ovate to sub-orbicular, somewhat concavo-convex, often nearly as wide as long ..... 8. *P. remota*

13: Involucral bracts loosely imbricate, not hiding the claws; lamina of intermediate involucral bracts ovate, more or less flat (sometimes slightly wrinkled in dry specimens), much narrower than long ..... 7. *P. eremaea*

14 Capituia mostly 10–20 mm diam.; plants annual; southern half of Australia ..... 9. *P. aristata*

14: Capitula mostly 20–30 mm diam.; plants perennial; eastern Australia ..... 15

15 Basal leaves linear, mostly 3–6 mm wide, glabrous or nearly so; apex of involucrai bracts usually long-acuminate to aristate; mostly grasslands ..... 4. *P. linearifolia*

15: Basal leaves usualiy lanceolate to oblanceoiate, rarely linear, mostly 5–20 mm wide, variously hairy; apex of involucral bracts acute to acuminate; various habitats ..... 1. *P. jaceoides*

16 Involucral bracts closely imbricate, hiding the claws, somewhat concavo-convex; small annuais from north-west and central Australia ..... 8. *P. remota*

16: Involucral bracts looseiy imbricate, not hiding the claws, more or less flat (sometimes slightly wrinkled in dry specimens); robust perennials from southern and eastern Australia ..... 17

17 Lamina of intermediate involucral bracts shorter than their claws; capitula usually 3–20 in terminal clusters ..... *P. hieracioides*

17: Lamina of intermediate invoiucral bracts similar in length or longer than their claws; capitula solitary or in loose or contracted cymes ..... 18

18 Basal and cauline leaves linear; piants ±glabrous or glabrescent except for prominent axillary hair tufts on basal leaves ..... 3. *P. laevigata*

18: Basal and cauline leaves not linear; plants variously hairy ..... 19

19 Basal leaves to 20 mm wide; stems often severai; capituia usually solitary, or rarely a few in loose cymes; slender plants mostiy of lowland habitats but extending into the alps ..... 2. *P. decipiens*

19: Basal leaves mostly 15–65 mm wide; stem usually solitary; capitula usuaily 5–11 in a dense contracted cyme; robust plants of montane to alpine habitats ..... 20

20 Basal leaves woolly to glabrescent, ovate to obovate, 35–65 mm wide, petioles winged; from mountainous areas of north-eastern New South Waies and south-eastern Queensland ..... *P. monticola*

20: Basal leaves glabrous or hairy, but not wooiiy, oblong to spathulate, mostly 15–35 mm wide, petioles not markedly winged; alpine and subalpine areas of south-eastern New 5outh Wales and Victoria ..... 21

21 Liguies of ray corolla yeiiow to orange, 9–13 mm long, teeth to 2 mm iong; claw of involucrai bracts c. 1 mm wide; capitula 15–25 mm diam.; mature cypselas <3 mm long ..... *P. robusta*

21: Ligules of ray corolla yellow, 14–20 mm iong, teeth 2–4.5 mm long; claw of involucral bracts 1.5–2 mm wide; capitula 25–30 mm diam.; mature cypselas 3–4.5 mm long ..... *P. laciniata*

## Taxonomy

**1. *Podolepis jaceoides*** (Sims) Voss, *Vilm. Blumengärtn.* ed. 3, 1: 536 (1894)

***Basionym:*** *Scalia jaceoides* Sims, *Bot. Mag.* 24: t. 956 (1806); *Podolepis acuminata* R.Br., *Hortus Kew.* edn 2, 5: 82 (1813), nom. illeg. (the earlier *Scalia jaceoides* is cited in synonymy); *Podolepis jaceoides* (Sims) Druce, *Rep. Bot. Exch. Club Soc. Brit. Isles, Suppl. 2.* 641 (1917), isonym; *Podolepis jaceoides* (Sims) Domin, *Biblioth. Bot.* 22(89): 1230 (1930), isonym.

***Type:*** **CULTIVATED.** 'A native of New South Wales, ... Introduced by Mr. Loddiges of Hackney,' (cultivated in England), not located (lectotype, illustration in *Bot. Mag.* 24: t. 956 (1806)!, here designated).

*Podolepis papillosa* R.Br. ex Pépin, *Ann. Fl. Pomone* 2: 88 (1833); *Podolepis papillosa* R.Br. ex Jacques, *Ann. Fl. Pomone* 3: 213 (1835) *isonym. Type*: 'Cultivated in the Jardin des Plantes, Paris, France', no locality, no date, no collector (neotype P, *fide* Mabberley (1999), *n.v.*).

*Podolepis contorta* Lindl., *Edwards's Bot. Reg.* 24: p. 64 misc. (1838). *Type:* 'A native of Van Diemen's Land, whence seeds of it were sent to the Horticultural Society by Mr. J. Bunce', not located.

*Podolepis simplicicaulis* F.Muell. *Second Rep. Gov. Bot. Veg. Colony* 12 (1854), nom. nud.

*Podolepis papillosa* Gand., *Bull. Soc. Bot. France* 65: 46 (1918), nom. illeg. *non* R.Br. ex Pépin (1833). *Type*: 'Australia, N. S. Wales *ad* Warrumbungle Range (*Forsyth!*), Victoria (*Walter!*)': New South Wales, Warrumbungle Ranges, x.1899, *W. Forsyth s.n.* (lectotype, LY 0000142, *fide* McGillivray (1973), photo!, isolectotype, NSW 25486, photo!, JSTOR Global Plants); NW Victoria, x.1900, C. *Walter s.n.* (excluded syntype, LY, photo! (= *P. aristata* subsp. *affinis*)).

*Illustrations*: Sims (1806) No. 956; Cunningham et al. (1981) p. 664; Cooke (1986) fig. 710 D; Everett (1992) p. 264.

*Herb* to 50 cm tall, renewed annually from perennial rootstock. *Stems* 1–several, produced annually from a thickened persistent rootstock, erect, unbranched or sparingly branched, variously woolly or cobwebbed, sometimes glabrescent. *Leaves* covered sparsely to densely with flattened elongate to coiled multicellular hairs, sometimes glabrescent, margins ±flat to revolute, entire; basal leaves several in a sparse rosette, usually lanceolate to oblanceolate, rarely linear, 3–15(–20) cm long and 5–15(–20) mm wide, petiolate, base amplexicaul covering an inconspicuous adaxial tuft of long hairs (white on dried specimens); cauline leaves alternate, sessile, stem-clasping, usually linear to linear-lanceolate, 1–10(–20) cm long and 2–10(–15) mm wide, apex acuminate. *Peduncles* 4–15 cm long, with several scarious scale leaves below the involucre passing into the leafy stem. *Capitula* hemispherical, mostly 20–40 mm diam., solitary or a few in loose cymes. *Involucral bracts* many-seriate, with linear glandular claws, unequal (outermost shortest, intermediate longest); lamina scarious, virtually flat (sometimes slightly wrinkled in dry specimens), smooth, shiny, ±ovate; intermediate bracts 10–18 mm long, apex acute to acuminate, often slightly asymmetric and twisted, claw c. 1 mm wide at the narrowest point and shorter than, to about as long as, the lamina; inner bracts with claw longer than lamina. *Florets* bright yellow; ray florets female, 20–50, ligules linear, 15–30 mm long, 3(–5)-toothed, teeth to 5 mm long, to c. 1 mm wide; disc florets bisexual, numerous. *Cypselas* 2–3 mm long, c. 1 mm wide, papillose; pappus bristles 20–40, barbellate, shortly connate at base, 6–10 mm long. (Figs 1a, 2)

***Selected specimens examined:*** **SOUTH AUSTRALIA.** Hindmarsh Island. 17.x.1930, *E.H. Ising 3853* (AD 97410208); Naracoorte, 3.xi.1945, *N.S. Tiver 14304* (AD 98672218); Mt Graham, 21.xi.1882, *Tate s.n.* (AD 97631670); Flinders Chase National Park, beside Cape du Couedic road, 21.x.1985, *J.H. Willis s.n.* (MEL 2119203); Swamps near Mt Benson, 1895, *Dr Englehart s.n.* (MEL 544018); Kingston – Lucindale railway corridor, 23.x.2006, *D.J. Duval 621* (AD 201366); Lake Bonney, 1882, *C. Wehl s.n.* (MEL 716639); Mt Gambier (MEL 716727); 4.5 km direct ESE of Maitland, 20.ix.1994, *R.L. Taplin & D.E. Murfet BS63-496* (AD 99705368); Freeling Cemetery, 23.x.1966, *D.N. Kraehenbuehl 1799* (AD 96713047); Sandergrove, c. 10 km SW of Strathalbyn, 2.xi.1926, *J.B. Cleland s.n.* (AD 95830060); Biscuit Flat c. 8 km SW of Conmurra, xi.1969, *K.M. Alcock 188* (AD 97041036). **QUEENSLAND.** Rockhampton, *A. Dietrich 1796, 259, 268, 1454* (MEL 544019, MEL 568369, MEL 568370, MEL 544020, AD 97943570); Terrick Terrick, 20.ix.1960, *S.L. Everist 6337* (AD 98619303, BRI 406093); Longreach, x.1913, *E. Jarvis s.n.* (BRI 365445); 'Burenda', Augathella, x.1998, *M. Pedon s.n.* (BRI 664025); Mitchell Highway, 98 km S of Cunnamulla, 18.ix.2004, *A.R. Bean 23137* (BRI 697235); 'Woolga', Tambo, 28.ix.1950, *G.A. Morrison s.n.* (BRI 365444); 12 km E of Capella, 8.iii.1995, *R.J. Fensham 2801* (BRI 639616); 8 km N of Clermont, 7.ix.1997, *R.J. Fensham 3315* (BRI 657938); South Galway, about 40 miles SW of Windorah, 2.viii.1963, *S.L. Everist 7418* (BRI 41211); 2

miles E of Peak Downs Station, 17.ix.1964, *Adams 1299* (C8G 143694). **NEW SOUTH WALES.** Kallara Station. Creek 4.5 km E of homestead along station track, 23.x.1981, *L. Hoegi 2073* (MEL 617177 (Fig. 2), AD 98227197); Berrigan, 29.x.1923, *J.L. Soues s.n.* (MEL 610531); Wilcannia, near Darling River, 27.ix.1976, *M.G. Corrick 5609* (MEL 628685); 34.2 km E of Bourke High School en route to Brewarrina, 20.viii.1987, *R.G. Coveny 12643* (MEL 115764, BRI 429168); River Road 10 miles S of Menindie, x.1979, *E. Baker s.n.* (AD 98672187); Matakana, 200 m SE of highway railway crossing, 8.x.2000, *K.D. Hill 5562* (AD 129136); Widdin Brook, 26 miles SW of Denman, 7.x.1959, *R. Story 6771* (CBG 72863, C8G 79657); c. 5 km E of Wollar on road to Bylong, 23.x.1990, *S.M. Prober s.n.* (CBG 491390); Travelling Stock Route 8 km N of Barraba, 1.x.1993, *S.M. Prober s.n.* (CBG 492529); Hunter Valley. "Darrowby" c. 3.5 km W of Broke along the road to Milbrodale, 3.x.1993, *J. Palmer 444* (CBG 474502). **AUSTRALIAN CAPITAL TERRITORY.** Queanbeyan-Cooma railway easement, 1 km S of Williamsdale Road, 19.iii.1993, *I. Crawford 2195* (CBG 9317307). **VICTORIA.** Rutherglen, 30.x.1936, *R.A. Black 481* (MEL 2301839, MEL 2300128); Cape Otway along coast at highest point, 12.iii.1962, *A.C. Beauglehole 19748* (MEL 1505398, AD 97907322); Near Oberon Bay Beach, Wilsons Promontory, 14.xi.1908, *Audos & St John s.n.* (MEL 64BB04); Chiltern Regional Park, Mt Pleasant Road N of Chiltern, 31.x.1979, *A.C. Beauglehole 66002* (MEL 1580237); Killawarra State Forest 20 km NW of Wangaratta P.O., 30.x.1979, *A.C. Beauglehole 65849* (MEL 15B0244); **TASMANIA.** V.D.L., *Gunn 362* (MEL 716723); Marshall Bay, Flinders Island, 16.x.1966, *J.S. Whinray 1616* (CBG 484659); Marshall Plains, Flinders Island, 14.vi.1877, *A. Simson 574* (HO 507893).

***Distribution and habitat:*** Found in South Australia, Queensland, New South Wales, Australian Capital Territory, Victoria and Tasmania. Most collections are from riverine woodlands and mallee in the arid zone of inland South Australia, Queensland and New South Wales, but also known from near coastal areas such as south-eastern South Australia, Rockhampton area, Sydney area, Wilsons Promontory, Cape Otway and Flinders Island. The near coastal occurrences of *Podolepis jaceoides* in south-eastern South Australia, Victoria and Flinders Island represent a significant incursion of this species into more mesic habitats. (Fig. 16a)

***Conservation status:*** Reasonably common, widespread and represented in conservation reserves.

***Flowering period:*** Mostly August to November.

***Cytology:*** No data available.

***Notes:*** The taxonomy and nomenclature of *Podolepis jaceoides* and related species has been problematic as is evident from the way these plants have been determined and arranged in the major Australian herbaria. The large number of names reduced to synonymy under *P. jaceoides* in the literature is also noteworthy (see Davis (1957) and APNI (2014)).

*Podolepis jaceoides* has long been regarded as a widespread and variable species from south-eastern Australia. In the protologue of *Scalia jaceoides*, Sims (1806) described the involucral bracts (referred to as calyx scales) as 'linear, terminated with a broader, ovate-acuminate, scariose [*sic*] appendix'. The accompanying illustration (Sims 1806) shows the lamina of the involucral bracts as having acute apices. Robert Brown (1813) described *Podolepis acuminata* R.Br., an illegitimate name as he cited the earlier *Scalia jaceoides* in synonymy. However, the choice of the epithet '*acuminata*' and his brief description of the involucral bracts (referred to as *calycis*) as '*aequatis ovatis acuminatis*' (Brown 1813) is evidence that the plants Brown saw had ovate-acuminate involucral bracts. The provenance of the original specimens of *P. jaceoides* and those Brown referred to as *P. acuminata* in the protologue is New South Wales (Sims 1806; Brown 1813), possibly in the vicinity of Port Jackson, although *P. acuminata* is not mentioned in the Robert Brown diaries (Vallance et al. 2001).

Prior to the current study, it was found that in all the Australian herbaria accessed, the preserved specimens stored under the name *P. jaceoides* had acuminate, acute, obtuse or retuse apices to the intermediate involucral bracts, suggesting that more than one taxon was present. Those with acute to acuminate apices to the intermediate involucral bracts can be separated readily into two distinct species based mainly on indumentum and involucral bract and leaf morphology (see Table 1). One of these species is *P. jaceoides* s. str., which agrees well with the illustration in Sims (1806), the other is a less widespread species primarily from grasslands herein described and named as *P. linearifolia* Jeanes.

Those specimens with retuse to obtuse apices to the intermediate involucral bracts can also be separated readily into two distinct species based on leaf morphology and indumentum (see Table 1). One is widespread and common in south-eastern Australia, and the other is rare and probably endemic to Victoria. The name *P. laevigata* Gand., applies to the latter while the widespread species is herein described and named as *P. decipiens* Jeanes.

***Typification:*** There is a specimen at MEL with an original label in Brown's hand, which reads 'R. Brown *Iter Australiense* 2258 *Podolepis acuminata* Br.', but with no locality information. A later worker has annotated the sheet 'Co-type material *Podolepis acuminata* R.Br. Robert Brown No. 2258 (Port Jackson, N.S.W.) 1802-5'. There is a duplicate of this collection (also numbered 2258) at the Natural History Museum, London (BM) with an original label in Brown's hand with the provenance given as Port Dalrymple (Launceston, Tasmania). It appears that both the MEL and the BM specimens were collected at Port Dalrymple (not Port Jackson) and hence are not type material of *P. acuminata*. This is further borne out by the fact that the involucral bract apices are not acuminate in these specimens. Unfortunately no herbarium specimens can be located that are type material of either *P. jaceoides* or *P. acuminata*, but it is clear that this species has at least some, if not all, of the involucral bracts ovate with acuminate apices.

The identity of *P. contorta* Lindl. from 'Van Diemen's Land' remains a mystery. The taxon was described as having acuminate involucral bracts (Lindley 1838), but I have seen no specimens from the Tasmanian mainland with bracts that match that description except for an old Gunn collection at MEL simply labelled V.D.L. However, *P. jaceoides* has been collected more recently on Flinders Island, so perhaps the type material (if any exists) had its origins there. Without any firm evidence to the contrary it is prudent to regard *P. contorta* as an unusual floral form of *P. jaceoides*. For additional commentary on synonomy of *P. jaceoides*, including *P. papillosa* R.Br. ex Pépin, *P. papillosa* R.Br. ex Jacques, *P. papillosa* Gand., see Mabberley (1999).

### 2. *Podolepis decipiens* Jeanes, sp. nov.

***Type:*** **VICTORIA.** SW of Mt Langi Ghiran between Western Highway and railway line, 2.xi.1981, *M.G.Corrick 7528* (holotype MEL 606866! (Fig. 3), isotypes, AD 98316202!, CBG 329381!, HO 58964!).

*Podolepis macrocephala* F.Muell. *First Rep. Gov. Bot. Veg. Colony* 14 (1853) nom. nud.

*Podolepis laevigata sensu* Victoria, Keilor Plains, ix.1900, *C. Walter s.n.* (excluded syntype, LY 0000144, photo!); Victoria, Mentone, 6.x.1907, *J.R. Tovey s.n.* (excluded syntype, LY 0000145, photo!) *non* Gand.

*Podolepis jaceoides sensu* Davis (1957), Cooke (1986), Everett (1992), Jeanes (1999) *p.p. non* (Sims) Voss.

*Illustrations*: Davis (1957) figs 2–7; Beadle (1980) fig. 292 A1–A5; Jeanes (1999) fig. 154h (all as *P. jaceoides*).

**Table 1.** A summary of the diagnostic characters and habitat information of *Podolepis jaceoides* and similar species. Length and width measurements are abbreviated as L and W respectively.

| | *P. decipiens* | *P. jaceoides* | *P. laevigata* | *P. linearifolia* |
|---|---|---|---|---|
| **Leaf indumentum** | woolly to scabrous with flattened multicellular hairs or glabrescent | woolly to scabrous with flattened multicellular hairs or glabrescent | ± glabrous | glabrous or with fine hairs on midrib below and on margins |
| **Basal leaf shape** | lanceolate to oblanceolate or ovate to obovate | lanceolate or oblanceolate, rarely linear | linear | linear |
| **Basal leaf size** | 30–200 mm L × 5–25 mm W | 30–200 mm L × 5–20 mm W | 50–130 mm L × 1–5 mm W | 50–170 mm L × 3–6(–10) mm W |
| **Hair tufts at base of basal leaves** | hidden by leaf bases | hidden by leaf bases | conspicuous | hidden by leaf bases |
| **Cauline leaf shape** | linear to linear-lanceolate | linear-lanceolate | linear | linear |
| **Cauline leaf size** | 10–100 mm L × 2–15 mm W | 10–200 mm L × 2–15 mm W | 10–80 mm L × 1–3 mm W | 10–80 mm L × 1–4 mm W |
| **Apex of intermediate involucral bracts** | retuse to obtuse | broadly acute, to acuminate, often twisted | retuse to obtuse | usually long-acuminate or aristate |
| **Habitat** | lowland to alpine forests, grasslands and herbfields | lowland forests, grassy woodlands and mallee scrubs | probably Buloke/ Grey Box woodlands | mostly grassland |

*Herb* to 70 cm tall, renewed annually from perennial rootstock. *Stems* 1–several, produced annually from thickened persistent rootstock, erect, unbranched or sparingly branched, variously woolly or cobwebbed, rarely glabrescent. *Leaves* covered sparsely to densely with flattened elongate to coiled, multicellular hairs, rarely glabrescent, margins ±flat to revolute, entire; basal leaves several in a sparse rosette, lanceolate, oblanceolate, ovate or obovate, 3–13(–20) cm long and 5–15(–30) mm wide, petiolate, base amplexicaul covering an inconspicuous adaxial tuft of long hairs (white or brown on dried specimens); cauline leaves alternate, sessile, stem-clasping, usually linear to linear-lanceolate, mostly 1–5(–10) cm long and 2–10(–15) mm wide, apex acuminate. *Peduncles* 4–10 cm long, with several scarious scale leaves below the involucre passing into the leafy stem. *Capitula* hemispherical, mostly 20–40 mm diam., usually solitary. *Involucral bracts* many-seriate, with linear glandular claws, unequal (outermost shortest, intermediate longest); lamina scarious, virtually flat (sometimes slightly wrinkled in dry specimens), smooth, shiny, ±ovate; intermediate bracts 7–15 mm long, apex retuse to obtuse, claw c. 1 mm wide at the narrowest point and shorter than, to about as long as, the lamina; inner bracts with claw longer than lamina. *Florets* bright yellow or orange; ray florets female, 20–40, ligules linear, 15–30 mm long, 3(–5)-toothed, teeth to 8 mm long, to c. 1 mm wide; disc florets bisexual, numerous. *Cypselas* 2–4 mm long, c. 1 mm wide, papillose; pappus bristles 20–40, barbellate, shortly connate at base, 6–10 mm long. (Figs 1b, 3)

***Selected specimens examined:*** **SOUTH AUSTRALIA.** Along road W of Italowie Gorge, Gammon Range National Park, 4.xi.1993, *R. Botes 34840* (MEL 2061695, AD 99427050); Hallett's Cove c. 20 km SW of Adelaide, 9.x.1920, *J.B. Clelond s.n.* (AD 97233373); Aldinga Bay on cliff top roadside, 3.xi.1983, *D.J.E. Whibley 8754* (AD 9B402259); c. 15 km W of Penola, 18.x.19B2, *J.Z. Weber 7684* (AD 9B317018); Honans Scrub, 20.xi.19BB, *R. Botes 16204* (AD 98850051); Mona Siding c. 5 km west of Bute, 12.x.1966, *D.J.E. Whibley 1651* (AD 97013233); Hundred of Ramsay, 24.xi.1968, *B.J. Bloylock 1147* (AD 97005190); Native Wells Native Forest Reserve S of Mt Burr, xi.2005, *R.J. Botes 66838* (AD 1B9540); Klein Point, S of Stansbury, 17.x.2006, *D.J. Duvol 599* (AD 201236); Botenella Hills, 30 km NE of Kimba, 28.viii.1992, *D.N. Kroehenbuehl 55B1* (AD 99327079); Burra, hilltop above the old copper mine, 21.x.1981, *N.N. Donner B376* (AD 98210248); Arthurton Primary School, x.2003, *R. Botes 61350* (AD 155379); Yorketown to Minlaton, 22.ix.1994, *R.J. Botes 38445* (AD 99606047). **QUEENSLAND.** Maryland, 5 border of Queensland, xi.1884, *E. Hukey 72* (MEL 716634). **NEW SOUTH WALES.** Kosciuszko National Park, near Cave Creek, c. 300 m upstream of Blue Waterhole area, 27.xi.2003, *N.G. Walsh s.n.* (MEL 2212513); 2.5 km W from Connors Hill, Snowy Mountain Highway, 10.ii.1996, *M. Ito 96075* (MEL 2030528); Sturt Highway, 16 km W of Euston towards Buronga, 12.x.2000, *R.G. Coveny 18810* (MEL 2067881, AD 11B642, CBG 550703); Mulloon Creek, 12 km due E of Hoskinstown, on the Hoskinstown-Braidwood road, 11.xii.1984, *M.J. Taylor 419* (MEL 294996); Cotter River District. Upper northern slopes of Mt Gingera, Bimbera Range, 10.i.1961, *R. Schodde 1240* (AD 96227169); East of Jenner S.F., c. 40 km N of Tenterfield, 19.x.2003, *A.R. Beon 21023* (BRI 576376); Rules Point N of Kiandra, 9.xii.1977, *I.R. Telford 6914* (CBG 7708537); Penrose State Forest between Marulan and Moss Vale, 28.x.1971, *R. Pullen 4410* (CBG 228550); 4 miles from Guyra along the Guyra-Ebor Road, 27.xi.1970, *I.R. Telford 240B* (CBG 37107); Morton National Park, via Bundanoon, 23.x.1965, *J. & R. McKeon 1158* (CBG 337593). **VICTORIA.** One Tree Hill Regional Park, 7.xi.1981, *A.C. Beauglehole 69840* (MEL 1580236); West Wall Flora and Fauna Reserve, 15.x.1986, *A.C. Beauglehole B6196* (MEL 1586474); 11 km SW of Wangaratta P.O., 6.xi.1985, *A.C. Beauglehole B13B7* (MEL 679B06); 14 km NNE of Wedderburn P.O., 12.viii.1975, *A.C. Beauglehole 50159* (MEL 2165830); Kooloonong, 1.x.1969, *N. MocForlone s.n.* (MEL 2160907); Timberoo Forest Reserve c. 18 km SW of Ouyen P.O., 20.ix.1972, *A.C. Beauglehole 40419* (MEL 1505399); Native Dog Plain, Benambra-Wulgulmerang Road, 9.i.1971, *A.C. Beauglehole 35970* (MEL 521110); Victoria Valley, Grampians, x.1976, *P.K. Gullon s.n.* (MEL 523917); Goat Track, Grampians, 22.xi.1972, *B. Conn s.n.* (MEL 645424); Melbourne-Bairnsdale rail-line, 2.6 km E of Munro, 1.xi.1991, *I.D. Lunt 91/44* (MEL 2011427); Wilkin c. 22.5 km SW of Casterton P.O., 30.x.1960, *A.C. Beauglehole 8235* (MEL 2160914); Alpine National Park, Wonnangatta-Moroka unit. Surveyors Ck Forestry Camp, beside water supply dam, 15.xii.2000, *N.G. Walsh 526B* (MEL 2089856). **TASMANIA.** Lake Ada, 14.ii.1992, *A. Moscol 22629* (HO 143749, MEL 7059969); Great Western Tiers, Lake Highway, 5.7 km N from Breona, 18.i.19B9, *F.E. Dovies 994 & P. Ollerenshow s.n.* (HO 134581, MEL 1600573, CBG B900345); Saddle c. 1 km NW of Pine Lake, 13.ii.1989, *P.S. Short 3397* (MEL 220233); Domain Hobart, 3.xii.1970, *Sworbrick 5540* (BRI 533392); Between Derwent River Bridge and Bronte, Tasmania, 27.i.1949, *N.T. Burbidge 3397* (HO 14530, CBG 19621); Talinah Lagoon, c. 5 km W of Lake Augusta, 2.iii.19B7, *R. Burns ANBG1167* (CBG 8700698); Top of Jacobs Ladder, Ben Lomond National Park, 29.i.2000, *A.C. Rozefelds 1605* (HO 504332); Epping Forest, 24.i.1986, *F. Duncon s.n.* (HO 506592); Ironstone Mountain, 19.i.1972, *D. Steone s.n.* (HO

532637); Waverley Flora Park, 4.xi.2007, *M. Wapstra 270* (HO 551947); Vale of Belvair, 14.iii.2010, *A.M. Buchonan 17372* (HO 555869); Pieman River heads, 23.ii.1930, *H.F. Camber 2116* (HO 14529).

***Distribution and habitat:*** Found in South Australia, Queensland, New South Wales, Victoria and Tasmania. Most collections are from a wide range of non-arid habitats including near coastal, alpine, sub-alpine and plains country grasslands, woodlands and open forests. In Queensland, known only from a single collection near Stanthorpe. (Fig. 16b)

***Conservation status:*** Reasonably common, widespread and present in conservation reserves.

***Flowering period:*** Mostly August to February, depending upon altitude.

***Cytology:*** No data available.

***Notes:*** *Podolepis decipiens* shows considerable variation across its range, but from the specimens available there appear to be no readily definable segregate taxa. Plants from alpine areas usually have a well-developed rosette of ovate to obovate leaves, relatively short unbranched stems, large capitula, often orange florets and the apex of the claws of the involucral bracts are usually reddish. All of these features can be observed in lowland plants, but rarely in combination. Some plants from grasslands near Melbourne have long, broad claws on the intermediate involucral bracts, sometimes exceeding the lamina and reminiscent of those of *P. hieracioides* F.Muell.

Apparent hybrids between *P. decipiens* and *P. rugata* Labill. subsp. *rugata* have been collected at Gorae West near Portland, Victoria (see notes under *P. rugata* subsp. *rugata*).

***Etymology:*** From the Latin *decipiens* = deceiving; this species is similar to, and has been confused with, *Podolepis jaceoides*.

### 3. *Podolepis laevigata* Gand., *Bull. Soc. Bot. France* 65: 46 (1918)

***Type:*** **VICTORIA.** 'Australia, Victoria *ad* Wimmera (*Reader!*), Keilor Plains (*Walter!*) et Mentone (*Tovey!*)': Pastures, Wimmera, 7.x.1892, *F.M. Reader s.n.* (lectotype, LY 0000143, *fide* McGillivray (1973), photo! (Fig. 4)); Keilor Plains, ix.1900, *C. Walter s.n.* (excluded syntype, LY 0000144, photo!); Mentone, 6.x.1907, *J.R. Tovey s.n.* (excluded syntype, LY 0000145, photo!). Both excluded syntypes are *P. decipiens*.

*Podolepis jaceoides sensu* McGillivray (1973) *non* (Sims) Voss.

*Herb* to 40 cm tall, possibly renewed annually from perennial rootstock. *Stems* several, produced annually from a thickened persistent rootstock, erect, unbranched, glabrous or glabrescent. *Leaves* virtually glabrous, margins ±flat to revolute, entire; basal leaves several in a sparse rosette, ± linear, 5–13 cm long and 1–5 mm wide, petiolate, base amplexicaul with a conspicuous adaxial tuft of long hairs (brown or white on dried specimens); cauline leaves alternate, sessile, linear, mostly 1–8 cm long and 1–3 mm wide, apex acuminate. *Peduncles* 4–8 cm long, with several scarious scale leaves below the involucre passing into the leafy stem. *Capitula* hemispherical, mostly 15–25 mm diam., usually solitary. *Involucral bracts* many-seriate, with linear glandular claws, unequal (outermost shortest, intermediate longest); lamina scarious, virtually flat (sometimes slightly wrinkled in dry specimens), smooth, shiny, ±ovate; intermediate bracts 7–12 mm long, apex retuse to obtuse, claw c. 1 mm wide at the narrowest point and shorter than, to about as long as, the lamina; inner bracts with claw longer than lamina. *Florets* bright yellow; ray florets female, 20–30, ligules linear, 10–20 mm long, 3(–5)-toothed, teeth to 4 mm long, 0.5–1 mm wide; disc florets bisexual, numerous. *Cypselas* 2–2.5 mm long, c. 1 mm wide, papillose; pappus bristles 20–40, barbellate, shortly connate at base, 5–8 mm long. (Figs 1c, 4)

***Specimens examined:*** **VICTORIA.** Charlton, x.1917, *W.W. Watts s.n.* (MEL 624730); Wimmera, Australia Felix, *s.dot., Anon. s.n.* (MEL 716596); NW of Horsham (MEL 716640); Daylesford, 1878, *R. Wallace 139* (MEL 274872); North-central. Nathalia, 10.x.1932, *J.H. Willis s.n.* (MEL 2165118); The Wimmera. Nhill, *St E. D'Alton 46* (MEL 716644); Wimmera, *Dollochy s.n.* (MEL 716656); Carrs Plain, *C. Walter s.n.* (MEL 2165537); Wycheproaf, ix.1917, *W.W. Watts 411* (MEL 624729); Wimmera, *Dollochy s.n.* (MEL 2165119); Warracknabeal, 10.xi.1891, *J.G.O. Tepper s.n.* (AD 97704546); Coromby, x.1889, *J.G.O. Tepper s.n.* (AD 97704575); Murray River, 1895, *H. Hawtharne s.n.* (MEL 1508132).

***Distribution and habitat:*** Apparently endemic to Victoria where it is found in the Wimmera, Riverina and Midlands Natural Regions (Conn 1993). Most of the collections are old and the labels contain no information on habitat. However, given the known distribution, it is possibly found mainly in *Allocasuarina luehmannii/*

*Eucalyptus microcarpa* woodland on heavy non-calcareous soils. (Fig. 16c)

***Conservation status:*** There are few collections of this species, the most recent of which was made in 1986. It appears that it may have always been localised and occurs in Buloke/Grey Box woodlands, which have been extensively cleared. There is no evidence that it occurs in any biological reserves. Recommend Endangered (3E) by criteria of Briggs and Leigh (1996) and Critically Endangered (CR) by criteria of IUCN (2013).

***Flowering period:*** September to November.

***Cytology:*** No data available.

***Typification:*** In the protologue of *Podolepis laevigata*, Gandoger provided the following Latin description: *Glaberrima, folia glaucescentia linearia, phylla involucri obtusa albida flosculis multo breviora, pappus niveus* (= very glabrous, leaves glaucous linear, involucral leaves (= bracts) obtuse whitish much shorter than the florets, pappus snowy white). As noted above, I consider the three syntype specimens to be representative of two species (*P. decipiens* and *P. laevigata*). McGillivray's (1973) selection of the Reader specimen as the lectotype is appropriate as it most closely matches Gandoger's description (1918).

***Notes:*** In general appearance this species resembles *Podolepis linearifolia*, but differs mainly in the intermediate involucral bracts having an obtuse apex and broader claws, and the rosette leaves having conspicuous tufts of axillary basal hairs. The two species also grow in different habitats.

### 4. *Podolepis linearifolia* Jeanes, **sp. nov.**

***Type:*** **VICTORIA.** Old RAAF Base Laverton, northwest corner of base, 10.xii.2007, *J.A. Jeanes 1805* (holotype, MEL 2296546! (Fig. 5), isotypes, CANB 699493!, NSW 832116!, K!).

*Podolepis* sp. aff. *jaceoides* (Basalt Plains) *sensu* Ross (1993).

*Podolepis* aff. *jaceoides sensu* Watanabe et. al. (1999).

*Podolepis* sp. 1 *sensu* Jeanes (1999).

*Podolepis* sp. Basalt Plain (V.Stajsic 2244) Vic. Herbarium *sensu* APNI (2014).

*Illustration:* Jeanes (1999) fig. 154i (as *Podolepis* sp. 1).

*Herb* to 60 cm tall, renewed annually from perennial rootstock. *Stems* usually several, produced annually from a thickened persistent rootstock, erect, usually unbranched, usually sparsely woolly or hispid, glabrescent with age. *Leaves* virtually glabrous, but often with fine hairs on abaxial midrib and on margins, margins ±flat to revolute, entire; basal leaves rosetted, numerous, ± linear, 5–17 cm long and 3–6(–10) mm wide, petiolate, base amplexicaul covering an inconspicuous adaxial tuft of long hairs (white on dried specimens); cauline leaves alternate, sessile, stem-clasping, linear, mostly 1–8 cm long and 1–4 mm wide, apex acute to acuminate. *Peduncles* 2–8 cm long, with several scarious scale leaves below the involucre passing into the leafy stem. *Capitula* hemispherical, mostly 20–30 mm diam., solitary or a few in loose cymes. *Involucral bracts* many-seriate, with linear glandular claws, unequal (outermost shortest, intermediate longest); lamina scarious, virtually flat (sometimes slightly wrinkled in dry specimens), smooth, shiny, ±ovate; intermediate bracts 7–15 mm long, apex usually long-acuminate to aristate, claw slender, c. 0.5 mm wide at the narrowest point and shorter than, to about as long as, the lamina; inner bracts with claw longer than lamina. *Florets* bright yellow or orange; ray florets female, 20–40, ligules linear, 10–30 mm long, 3(–5)-toothed, teeth to 5mm long, to c. 1mm wide; disc florets bisexual, numerous. *Cypselas* 2–3 mm long, c. 1 mm wide, papillose; pappus bristles 20–40, barbellate, shortly connate at base, 6–9 mm long. (Figs 1d, 5) Chromosome numbers: $n$=10, $2n$=20.

***Selected specimens examined:*** **SOUTH AUSTRALIA.** 10 km SW of Burra on Adelaide-Peterborough road, 19.x.1981, *N.N. Donner 8166* (AD 98210352, CBG 350200, HO 63478); Button Grass swamp near Mt Burr, 30.x.1977, *R. Botes 4009* (AD 97748024); Hynum and Robertson, 3.xi.1945, *N.S. Tiver s.n.* (AD 98672181). **NEW SOUTH WALES.** Berrigan, 29.x.1923, *J.L. Sones s.n.* (CBG 339068). **VICTORIA.** RAAF Air Base, Laverton, 5.xi.1996, *N.G. Walsh 4637* (MEL 2051250); About 3.5 km north of Rowsley, 28.x.2000, *V. Stojsic 2698 & 2699* (MEL 2135003, MEL 2135004, HO 523357, CANB 554769); Derrimut Grasslands, above northern edge of Andersons Swamp, 10.xi.1995, *P.S. Short 4574* (MEL 2028052); 15 km west of Maryborough P.O., 22.xi.1979, *A.C. Beauglehole 66600* (MEL 1580243); Near Omeo, 1893, *D. Sullivon 7* (MEL 716537); Immediately SW from Deer Park Railway Station on the Ballarat line, 14.xii.1992, *V. Stojsic 2244* (MEL 2102870); Deer Park, corner of Fitzgerald and Boundary Roads, 29.x.1991, *R. Robinson s.n.* (MEL 2011738); Railway easement 4.5 km west of Glenrowan, southern verge, 30.xi.2003, *R. Thomos 779* (MEL 2220642); Intersection of Dingee-Rochester Road and Bendigo-Tennyson Road, x.2003, *D. Morsholl s.n.* (MEL 2236280);

Winghee Swamp, bend in Tennyson-Huntly Road, 14.ix.1992, *P. Foreman M125* (MEL 2016852).

***Distribution and habitat:*** Scattered across south-eastern Australia between the Clare Valley in South Australia and Omeo in Victoria. Mostly found on grasslands, but may also occur in grassy woodlands, open forests and around swamps. (Fig. 16d)

***Conservation status:*** Overall *Podolepis linearifolia* is probably vulnerable as much of its former habitat has been lost to rural and urban development. In Victoria it now persists in small isolated pockets, mostly on the basalt plains grasslands to the north and west of Melbourne and on the northern plains grasslands (both EPBC listed threatened communities). Its current status in New South Wales, based on a single 1923 collection, is unknown. In South Australia it is known from very few collections mostly in the south-east of the state. Most known localities for this species are on small road and rail reserves which are vulnerable to weed invasion, altered fire regimes, browsing by stock and feral animals, and road and rail works. Due to the extensive loss of habitat and the paucity of recent collections, I would suggest Vulnerable (3VC-) by criteria of Briggs and Leigh (1996) and Vulnerable (VU) by criteria of IUCN (2013).

***Flowering period:*** September to December.

***Cytology:*** Chromosome number determinations of $n$=10, $2n$=20 were reported by Watanabe et al. (1999) under the name *Podolepis* aff. *jaceoides* (Sims) Voss.

***Notes:*** This species was first recognised in Ross (1993) as *Podolepis* sp. aff. *jaceoides* (Basalt Plains). Since that time it has become well known to many botanists and plant survey workers in the Victorian grasslands. It is readily distinguished from *P. jaceoides* by its linear, usually glabrescent basal leaves, generally smaller capitula, narrower claws and long-acuminate laminas on the intermediate involucral bracts.

***Etymology:*** From the Latin *linearis* = linear, *folia* = leaf; the leaves of this species are more or less linear.

**5. *Podolepis rugata*** Labill., *Nov. Holl. pl.* 2: 57, t. 208 (1806)

***Type:*** **WESTERN AUSTRALIA.** *'In terrâ Van-Leuwin,' Nova Hollandia*, no date, *Labillardiere s.n.* (lectotype, GH00011355 (left-hand specimen only), here designated, photo! JSTOR Global Plants).

Erect or decumbent *herb* to 50 cm tall, renewed annually from a perennial thickened rootstock. *Stems* 1–several,

**Table 2.** A summary of the diagnostic characters of the subspecies of *Podolepis rugata* and habitat information. Length and width measurements are abbreviated as L and W respectively.

| | *P. rugata* subsp. *rugata* | *P. rugata* subsp. *littoralis* | *P. rugata* subsp. *glabrata* | *P. rugata* subsp. *trullata* |
|---|---|---|---|---|
| **Leaf indumentum** | ± lanate | ± glabrous | ± glabrous | ± glabrous |
| **Basal leaf shape** | linear to linear-lanceolate | oblanceolate | linear to linear-lanceolate | oblanceolate |
| **Basal leaf size** | 30–100(–150) mm L × 3–13(–20) mm W | 50–120 mm L × 3–10 mm W | 30–100(–150) mm L × 3–13(–20) mm W | 50–120 mm L × (4–) 8–14 mm W |
| **Cauline leaf shape** | linear to linear-lanceolate | oblanceolate to spathulate | linear to linear-lanceolate | oblanceolate to spathulate |
| **Cauline leaf size** | 30–80(–100) mm L × 2–10 mm W | 50–100(–160) mm L × 5–10(–15) mm W | 10–80(–100) mm L × 2–10 mm W | 30–60(–100) mm L × 3–5(–10) mm W |
| **Shape of intermediate involucral bract lamina** | ovate | ovate to ovate-lanceolate | ovate | trullate |
| **Surface of intermediate involucral bract lamina** | transversely rugose | transversely rugose | transversely rugose | virtually flat (tips reflexed) and smooth |
| **Apex of intermediate involucral bracts** | obtuse | obtuse | obtuse | acute to acuminate |
| **Habitat** | mostly inland mallee scrubs | coastal sand dunes | mostly inland mallee scrubs | coastal sand dunes |

**Key to the subspecies of *Podolepis rugata***

1 Lamina of intermediate involucral bracts narrow-trullate, virtually flat except for reflexed tips, smooth; leaves glabrous; Yorke Peninsula and Kangaroo Island South Australia ..... **5d. *P. rugata* subsp. *trullata***

1: Lamina of intermediate involucral bracts ovate or oblong, deeply transversely rugose; leaves glabrous or hairy; widespread ..... **2**

2 Plants decumbent, lacking a definite basal rosette; leaves fleshy, glabrous, oblanceolate; lamina of intermediate involucral bracts ovate to oblong; near-coastal scrub on sand; South Australia ..... **5c. *P. rugata* subsp. *littoralis***

2: Plants erect, with a definite basal rosette; leaves thin-textured, hairy or glabrous; lamina of intermediate involucral bracts ovate; habitats various; widespread ..... **3**

3 Plants variously woolly; southern Australia ..... **5a. P. *rugata* subsp. *rugata***

3: Plants virtually glabrous; South Australia and Victoria ..... **5b. P. *rugata* subsp. *glabrata***

unbranched or sparingly branched, variously woolly, cobwebbed or glabrous. *Leaves* woolly, cobwebbed or glabrous, margins ±flat to revolute, entire, apex obtuse or acute to acuminate; basal leaves several in a sparse rosette, soon withering, or absent, narrow-lanceolate to oblanceolate, 3–10(–15) cm long and 3–13(–20) mm wide, petiolate; cauline leaves alternate, sessile, stem-clasping, fleshy or thin-textured, linear to linear-lanceolate or oblanceolate to spathulate, 1–10(–16) cm long and 1–10(–15) mm wide. *Peduncles* 3–10 cm long, with several scarious scale leaves below the involucre passing into the leafy stem. *Capitula* hemispherical, mostly 12–30 mm diam., solitary or a few in loose cymes. *Involucral bracts* many-seriate, with linear glandular claws c. 1 mm wide, unequal (outermost shortest, intermediate longest); lamina scarious, often golden-brown, usually deeply, transversely rugose, oblong to ± ovate, rarely almost flat (except for reflexed tips) and narrow-trullate (in subsp. *trullata*); intermediate bracts 6–15 mm long, apex obtuse to acuminate, claw about as long as, or longer than, the lamina; inner bracts with claw much longer than lamina. *Florets* bright yellow; ray florets female, 30–70, ligules linear, 10–25 mm long, 3(–5)-toothed, teeth to 5 mm long, to c. 1 mm wide; disc florets bisexual, numerous. *Cypselas* 2–3 mm long, c. 1 mm wide, papillose; pappus bristles 30–60, barbellate, shortly connate at base, 6–10 mm long. Chromosome numbers: $n$=10, $2n$=20.

***Cytology:*** Chromosome number determinations of $n$=10, $2n$=20 were reported by Turner (1967) and Watanabe et al. (1999). Vouchers cited by Turner here refer to *Podolepis rugata* subsp. *rugata*, and that by Watanabe et al. to *P. rugata* subsp. *glabrata* Jeanes.

## 5a. *Podolepis rugata* Labill. subsp. *rugata*

*Illustrations*: Labillardiere (1806) t. 208; Grieve & Blackall (1975) p. 792 (both as *P. rugata*).

Erect *herb* to 50 cm tall. *Stems* 1–several, erect, unbranched or sparingly branched, variously woolly or cobwebbed. *Leaves* woolly or cobwebbed, thin-textured; basal leaves several in a sparse rosette, soon withering; cauline leaves usually linear to linear-lanceolate, 1–10(–12) cm long and 2–10(–15) mm wide. *Capitula* solitary or a few in loose cymes,12–25 mm diam. *Involucral bracts* with lamina scarious, often golden-brown, deeply transversely rugose, ±ovate, apex obtuse. (Figs 1e, 6)

***Specimens examined:*** **WESTERN AUSTRALIA.** 7 km N of Mt Esmond; 172 km NE of Esperance, 19.ix.1995, *B. Archer 102* (MEL 2039182 (Fig. 6)); Eyre Botanical District. E of Barker Inlet, 4.i.1992, *W.R. Archer 401924* (MEL 2018560); Coolgardie Botanical District. 36.9 km W of Balladonia, 17.x.1995, *K. Wotonobe 341* (MEL 2027531); 22 miles E of Cocklebiddy, 13.ix.1965, *B.L. Turner 5576* (MEL 602792); 387 km E of Norseman, 4.ix.1962, *T.E.H. Aplin 1720* (MEL 2165855); c. 20 km S of Ravensthorpe on Hopetoun Road, 9.xi.1983, *P.S. Short 2349 & L. Haegi s.n.* (MEL 1525042); c. 173 km along Eyre Highway east of Balladonia Hotel, 24.x.1968, *Hj. Eichler 20434* (AD 97424200); Quarrum Nature Reserve, E of Irwin Inlet, 26.xi.2003, *R.J. Cranfield 19527* (CANB 594130). **SOUTH AUSTRALIA:** 10.1 km E of Nundroo, 16.x.1995, *K. Wotonobe 337* (MEL 2027520, AD 99609140); Nullarbor Plain, 1.6 km W of Ivy Tanks Eyre Peninsula, 31.viii.1974, *A.C. Beauglehole 49482* (MEL 1602543); Nullarbor. 12 km S of highway along western dog fence, 21.x.1983, *H.R. Toelken 7584* (MEL 1575134, AD 98415015, CBG 8800077); Eastern Nullarbor Plain. Tallowan Tank c. 75 km NW of Fowlers Bay, 7.x.1954, *J.B. Cleland s.n.* (AD 97233251); 20 km W of Yalata Roadhouse, 27.ix.1984, *A. Robinson 7593* (AD 98524008); North West Plains. c. 56 km east of the Western Australian border, near

the Eyre Highway, 15.ix.1960, *P. Wilson 1665* (AD 96140057); 5 miles W of Nundroo on Eyre Highway, 16.xi.1968, *J.W. Wrigley s.n.* (CBG 32875). **VICTORIA.** Mouth of the Glenelg, *W. Allitt s.n.* (MEL 222521); In Victoria on the Glenelg River, 1857, *F. Mueller s.n.* (MEL 2165850); Nelson Bay Coastal Reserve, 2.x.1982, *A.C. Beauglehole 71146* (MEL 1579763); Portland, *W. Allitt s.n.* (MEL 222522).

***Distribution and habitat:*** Scattered across the southern part of Western Australia and South Australia as far east as the Portland district of south-west Victoria, in a range of habitats including mallee, chenopod scrubland, grassland, woodland and coastal dune scrubland. (Fig. 16e)

***Conservation status:*** Widespread, moderately common and well represented in conservation reserves.

***Flowering period:*** August to November.

***Notes:*** Some specimens from coastal areas of Western Australia (e.g. Cape le Grande, Oldfield River mouth) approach subsp. *littoralis* in overall appearance, but they have the woolly leaves and stems of subsp. *rugata*. Apparent hybrids between *Podolepis rugata* subsp. *rugata* and *P. decipiens* have been collected at Gorae West near Portland, Victoria. The overall appearance of these plants and the size and shape of the involucral bracts suggests determination as *P. decipiens*, but the bracts are shallowly transversely rugose, which is a character found in *P. rugata*.

### 5b. *Podolepis rugata* subsp. *glabrata* Jeanes, subsp. nov.

***Type:*** **VICTORIA.** Murray-Sunset National Park. Near the intersection of Nowingi Line Track and Rocket Lake Track, 24.xi.2011, *J.A. Jeanes 2744* (holotype, MEL 2356596! (Fig. 7), isotypes CANB!, S!, PAL!).

*Podolepis centauroides* F.Muell. in sched., nom. nud. (MEL 222507).

*Illustration:* Jeanes (1999) fig. 154e (as *P. rugata* var. *rugata*).

Erect *herb* to 50 cm tall. *Stems* 1–several, erect, unbranched or sparingly branched, more or less glabrous. *Leaves* more or less glabrous, thin-textured; basal leaves several in a sparse rosette, soon withering; cauline leaves usually linear to linear-lanceolate, 1–10(–12) cm long and 2–5(–10) mm wide. *Capitula* solitary or a few in loose cymes, 12–25 mm diam. *Involucral bracts* with lamina scarious, often golden-brown, deeply transversely rugose, ±ovate, apex obtuse. (Figs 1f, 7)

***Specimens examined:*** **SOUTH AUSTRALIA.** Hambidge Conservation Park, 4.8 km 5W of Prominent Hill, 29.ix.1983, *J.D. Briggs 1275* (MEL 678056, AD 98721203, CBG 8315971); Swan Reach, 5 km from Nildottie, 27.x.1995, *E. Salkin 165* (MEL 2070952); 7 km E of Tailem Bend on Route 12 (Mallee Highway), 17.x.1996, *K. Watanabe 696* (MEL 2034808, AD 99741233); About 10 km west of Walker Flat, 24.ix.1979, *A.G. Spooner 6513* (AD 98041248); Billiat Conservation Park, 29.xi.1984, *R.V. Southcott 8932* (AD 98513273); Willaston, c. 40 km NNE of Adelaide, 5.ix.1957, *D. Krahenbuehl 2722* (AD 97712595); Moonta Bay, Marine Parade, 3.xi.1982, *D.J.E. Whibley 8411* (AD 98313124); Crown lands WNW of Kimba, 5.x.1981, *C.R. Alcock 8851* (AD 98152128); 4 miles W of Stenhouse Bay, 19.x.1966, *M.E. Phillips s.n.* (CBG 28318). **VICTORIA.** Big Desert S.F. – south of Danyo, 10.xii.2003, *I.R.K. Sluiter 04-08* (MEL 2236277); Big Desert. Archibold Track 8.7 km S of Nine Mile Square Track, 21.xi.1986, *G.R. Lucas 394* (MEL 113771); Wyperfeld National Park – Dattuck Track, 7.xi.1979, *A. Morton 439* (MEL 2165848); Sunset Country. Berrook Track 25.8 km W of Sunset Tank, 14.x.1986, *G.R. Lucas 296* (MEL 690575, CBG 8905075); Murray-Sunset National Park. Bambill South Track, 5.8 km S of Settlement Road, 25.xi.2011, *J.L. Birch 446* (MEL 2355902); Underbool Track about 10.9 km south of Pheeneys Track, 8.x.2008, *J.A. Jeanes 1976* (MEL 2325541, CANB 709602); 33 km south of Murrayville, 21.xi.1981, *E. & G. Gardiner s.n.* (AD 98151048); 60 km SW of Mildura, 1 km S of Rocket Lake eastern end, 9.x.1977, *B. Barnsley 079, M.D. Crisp s.n. & D.J. Cummings s.n.* (CBG 7706684).

***Distribution and habitat:*** Scattered across South Australia, east from the Eyre Peninsula, and into north-eastern Victoria in mallee scrublands, woodlands and open forests. (Fig. 16f)

***Conservation status:*** Widespread, moderately common and well represented in conservation reserves.

***Flowering period:*** September to November.

***Notes:*** Subspecies *glabrata* is similar in overall appearance to subsp. *rugata*, but is usually quite glabrous or at least early-glabrescent.

***Etymology:*** From the Latin *glabrata* = almost without hairs; the plants of this subspecies are more or less hairless.

### 5c. *Podolepis rugata* subsp. *littoralis* (G.L.Davis) Jeanes, stat. nov.

***Basionym:*** *Podolepis rugata* Labill. var. *littoralis* G.L.Davis, *Proc. Linn. Soc. New South Wales* 81: 267–268, figs 73–74 (1957).

***Type:*** **SOUTH AUSTRALIA.** Cape Couedie (=Cape du Couedic), Kangaroo Island, i.1907, *R.S. Rogers s.n.* (holotype, NSW 25380, photo!).

*Illustrations:* Davis (1957) fig. 73 (as *P. rugata* var. *littoralis*).

Erect or decumbent *herb* to 30 cm tall. *Stems* 1–few, unbranched or sparingly branched, glabrous. *Leaves* glabrous, fleshy; basal leaves not in a well-defined rosette, several, oblanceolate, 5–12 cm long, 3–10 mm wide; cauline leaves usually oblanceolate to spathulate, 3–10(–16) cm long and 5–10(–15) mm wide. *Capitula* often solitary on long peduncles, 12–25 mm diam. *Involucral bracts* with lamina scarious, often golden-brown, deeply transversely rugose, ovate to ovate-lanceolate, apex obtuse. (Figs 1g, 8)

***Specimens examined:*** **SOUTH AUSTRALIA.** D'Estree Bay, *J.G.O. Tepper s.n.* (MEL 716242 (Fig. 8)); Greenly Island, off the south-west coast of Eyre Peninsula, 29.xi.1976, *T.S. Fatchen s.n.* (AD 97709143); Lincoln National Park, north-east of Tournefort, 6.xi.1979, *P.C. Heyligers 79031* (AD 98009414, CANB 288544); Southern Kangaroo Island. Between Kingscote and Vivonne Bay, *J.B. Cleland s.n.* (AD 97233381); Innes National Park, lowermost dune leading from "Ethel" Wreck Beach, 7.x.1974, *D.E. Symon 9568* (AD 98672169); Kangaroo Island. Pennington Bay, 12.i.1987, *D. Symon 14287* (AD 98705503); On cliffs at Port Noarlunga c. 27 km SSW of Adelaide, 5.x.1926, *J.B. Cleland s.n.* (AD 97233382); Coffin Bay National Park, 12.x.2001, *S. Williams CBP295* (AD 131179); 53 miles from Port Lincoln towards Cowell, 21.xi.1968, *J.W. Wrigley s.n.* (CBG 32490).

***Distribution and habitat:*** Confined to coastal dune scrublands in South Australia between Adelaide and Streaky Bay. (Fig. 16g)

***Conservation status:*** Widespread, moderately common and well represented in conservation reserves.

***Flowering period:*** September to November.

***Typification:*** Davis (1957) nominated a single element of NSW 25380 as the holotype of *Podolepis rugata* var. *littoralis* and the other two elements as paratypes. Since there is a single label and all three elements appear to be part of the same collection, the whole sheet should be regarded as the holotype.

***Notes:*** Some specimens of *Podolepis rugata* subsp. *rugata* from coastal areas of Western Australia (e.g. Cape le Grande, Oldfield River mouth) approach subsp. *littoralis* in overall appearance, but they have the typical woolly leaves and stems of the former.

### 5d. *Podolepis rugata* subsp. *trullata* Jeanes, subsp. nov.

***Type:*** **SOUTH AUSTRALIA.** Yorke Peninsula. Road to Cape Spencer Lighthouse, SE side of road. Innes National Park, 7.xi.2006, *T. Jaques INP-296 & T. Lewis* (holotype, AD 197477!, isotype MEL 2366399!) (Fig. 9).

Erect or decumbent *herb* to 40 cm tall. *Stems* 1–few, unbranched or sparingly branched, glabrous. *Leaves* glabrous, fleshy; basal leaves not in a well-defined rosette, several, oblanceolate, 5–12 cm long, (4–)8–14 mm wide; cauline leaves usually oblanceolate to spathulate, 3–6(–10) cm long and 3–5(–10) mm wide. *Capitula* often solitary on long peduncles, 12–25 mm diam. *Involucral bracts* with lamina scarious, transparent white, virtually flat (sometimes slightly wrinkled in dry specimens), smooth, narrow-trullate, apex acute to acuminate, reflexed at and before anthesis. (Figs 1h, 9)

***Selected specimens examined:*** **SOUTH AUSTRALIA.** Innes National Park about 1 km inland from Pondalowie Bay, 10.x.1980, *P.C. Heyligers 80142* (CANB 294329, AD 98050343); Cape Spencer Lighthouse Road (down slope) western side, 20.x.2005, *T. Jaques INP-110 & T. Lewis s.n.* (AD 186191); West Cape in Innes National Park, 16.x.2008, *D.J. Duval 1300 & K.H. Brewer* (AD 231084); Busby Islet, 22.xi.1982–1.xii.1982, *K. Casperson 3145* (AD 98301037); Innes National Park, southern end of eastern boundary, 6.x.1974, *C.R. Alcock 4538* (AD 97524004); Innes National Park, Royston Head, 11.x.1974, *J.Z. Weber 4242* (AD 97445340); Althorpes, ix.1907, *R.S. Rogers s.n.* (AD 97241116); Innes National Park, Shell Beach, x.2003, *R. Bates 61380* (AD 155444); Cape Spencer, Innes National Park, 13.ix.2006, *D.J. Duval 576* (AD 198111).

***Distribution and habitat:*** Endemic to South Australia where known from several localities on the southern Yorke Peninsula (mostly within the Innes National Park), Althorpe Islands and Busby Islet off Kangaroo Island where it grows in near-coastal scrub on sandy soil. One locality is described as low *Eucalyptus diversifolia* mallee scrubland. Plants often grow amongst and out of low bushes in fairly dense scrub. (Fig. 16h)

***Conservation status:*** Most known localities are in close proximity to each other and are protected within a biological reserve, but this taxon is most likely rare. I suggest Rare (2RCt) status by criteria of Briggs and Leigh (1996) and Near Threatened (NT) by criteria of IUCN (2013).

***Flowering period:*** September to November.

***Notes:*** *Podolepis rugoto* subsp. *trullata* has been confused with *P. rugota* subsp. *littorolis*, but in the latter the laminas of the involucral bracts are ovate to oblong, deeply transversely rugose and apically obtuse.

***Etymology:*** From the Latin *trulloto* = shaped like a brick-layer's trowel; this is the shape of the lamina on the intermediate involucral bracts.

**6. *Podolepis canescens*** A.Cunn. ex DC., *Prodr.* 6: 163 (1838)

***Type:*** **NEW SOUTH WALES.** *'in collibus rupestribus circò Croker's ronge in Novô-Hollandiô od occid. Vollis Wellingtonioe nov. flor. legit cl. Cunninghom...(v.s. comm. ò cl. inv.)'*: Croker's Range, xi.1825, *A. Cunninghom 39* (lectotype, BRI-AQ354837, *fide* G.L. Davis (1957), photo! J5TOR Global Plants, isolectotype, MEL 696480!); Rocky hills near Croker's Range in the country lying W from Wellington valley, xi.1825, *A. Cunningham 127* (possible isolectotype, MEL 2280347!); Exposed rocky sides of hills, Croker's Range, xi.1825, *A. Cunningham 1763* (possible isolectotype, BM 810533, photo! JSTOR Global Plants); Hills of Croker's Range, 1825, *A. Cunninghom s.n.* (residual syntype, BM 810534, photo! JSTOR Global Plants).

*Podolepis inundoto* A.Cunn. ex DC., *Prodr.* 6: 163 (1838). *Type*: New South Wales. *'in inundatis od ripas flum. Lochlon in Novô-Holl. (v.s. comm. ò cl. invent.)'*: Inundated parts of L. R., no date, *A. Cunninghom s.n.* (lectotype, K 000899338, here designated, photo! JSTOR Global Plants); Damp banks (liable to inundation) of the Lachlan River N. S. Wales, 29.iv.1817, *A. Cunninghom 47* (probable isolectotype, K 000899337, photo! JSTOR Global Plants).

*Podolepis rubida* Maiden & R.T.Baker, *Proc. Linn. Soc. New South Wales* 10: 587 (1895). *Type*: New South Wales. Bathurst, 20.xi.1895, *W.J.C. Ross s.n.* (holotype, MEL 716219!).

Annual *herb* to 60 cm tall. *Stems* 1–several, erect, usually branched, sparsely woolly, often glabrescent, reddish. *Leaves* woolly below, sparsely woolly above and often glabrescent, margins ± revolute, entire; basal leaves often few in a sparse rosette, not always present at anthesis, usually linear-oblanceolate, 5–8 cm long and 2–7 mm wide, petiolate, base amplexicaul, apex acute; cauline leaves alternate, sessile, stem-clasping, decurrent, usually linear, 1–5 cm long and 2–4 mm wide, apex acute. *Peduncles* 1–4 cm long, with several scarious scale leaves below the involucre passing into the leafy stem. *Copitulo* hemispherical, mostly 5–8(–10) mm diam., many in loose cymes, rarely solitary. *Involucral brocts* many-seriate, with slender linear, glandular claws, unequal (outermost shortest, intermediate longest); lamina scarious, straw-coloured to golden brown, shallowly transversely rugose at least distally, shiny; intermediate bracts 2–6 mm long, apex acute or shortly acuminate, claw c. 0.25 mm wide at the narrowest point and often longer than the lamina, lamina lanceolate to ovate, 1–2.5 mm long, base truncate to obtuse; inner bracts with claw much longer than lamina. *Florets* yellow; ray florets female, 20–30, ligules linear, 6–10 mm long, usually 3-toothed, teeth to 3 mm long, to c. 0.5 mm wide; disc florets bisexual, numerous. *Cypselas* terete, c. 1.5 mm long, c. 0.5 mm wide, papillose; pappus bristles 15–20, barbellate, virtually free, 3–4 mm long. (Figs 1i, 10)

***Specimens examined:*** **NEW SOUTH WALES.** 1.9 km west of Glen Alice on road towards Rylstone, 15.xii.2005, *R. Johnstone 1711* (MEL 2264178 (Fig. 10), NSW 493723, K); 1.7 km SSE along Charlton Road from the Windsor-Singleton Road, c. 3 km NE of Bulga, 27.ix.2009, *R.G. Coveny 19387* (MEL 2340151, NSW 592543, BRI, CANB, NE); Hill End, x.1885, *Dr. J. Lauterer 31* (MEL 696402); N. S. Wales, *A. Cunningham s.n.* (MEL 2160879 part A); Dubbo, vii.1883, *Betche 63* (MEL 696403); Dubbo, 14.ix.1883, *Betche 60* (MEL 716218); c. 2 km west of Glen Alice on road to Rylstone, 4.xii.2007, *R. Johnstone 2286 & A.E. Orme* (CANB 712079, NSW 759349, K).

***Distribution and habitat:*** Found mostly in the Central Tablelands and Central Western Slopes of New South Wales. Habitats include open forests, woodlands and grassy woodlands. (Fig. 17a)

***Conservation status:*** The paucity of collections, particularly recent ones, in Australian herbaria suggests that this species is probably quite rare and possibly threatened. Suggest Poorly Known (K-) by criteria of Briggs and Leigh (1996) and Near Threatened (NT) by criteria of IUCN (2013).

***Flowering period:*** Mostly August to November.

***Cytology:*** No data available.

***Notes:*** Distinguished from other *Podolepis* species by a combination of characters including its upright twiggy habit, small capitula and tiny, transversely rugose involucral bract laminas. In overall appearance, *P. canescens* resembles *P. eremaea*, but that species has virtually flat involucral bract laminas (sometimes

slightly wrinkled in dry specimens) and favours more arid habitats.

***Typification:*** The type locality of *Podolepis canescens* is the Crokers Range about 70 kilometres south-west of Wellington in New South Wales. Excellent type material is available that shows the plants to be tall and slender with linear leaves and small capitula (mostly < 8 mm diameter). The intermediate involucral bracts have tiny (~ 3 mm long) ovate-acuminate, shallowly transversely rugose laminas on long slender claws often exceeding the lamina. Plants fitting this description are found from the Central Tablelands and Central Western Slopes of New South Wales.

All the type specimens bar one are designated as having been collected in November 1825, and all were from, or near, the Croker's Range. Although these specimens are numbered differently, it is unclear whether these are shipping numbers associated with specimen dispersal by Cunningham to the British Museum and to de Candolle, or collection numbers (Orchard 2012; Orchard & Orchard 2013). Hence, despite differing numbers, it is possible that at least two of the residual syntypes could in fact be isolectotypes.

The type sheet of *Podolepis inundata* in the Herbarium Hookerianum at Kew Botanic Gardens contains five elements, all of the same taxon and probably part of the same gathering. The sheet has been split rather arbitrarily into two parts, each part with a separate collecting label and a different herbarium number. The two elements on the right hand side (K 000899338) have been selected as the lectotype as they are more complete and in better condition than the three elements on the left (K 000899337).

### 7. *Podolepis eremaea* Jeanes, sp. nov.

***Type:*** **WESTERN AUSTRALIA.** Ashburton Botanical District. Rocky slope c. 17 km SW of Kumarina, 27.viii.1995, *P.S. Short 4247* (holotype MEL 2027659! (Fig. 11), isotypes AD!, BRI!, CANB!, K!, NSW!, PERTH!, S!, TI!).

*Podolepis canescens* var. *affinis sensu* F.Muell. & Tate *p.p.* (in respect to *Helms s.n.* (MEL 2160903!)) *non* (Sond.) F.Muell. & Tate.

*Podolepis* sp. *sensu* Watanabe et al. (1999: Kumarina W.A. *P.S. Short 4247*).

*Podolepis* sp. Carnarvon Range (D.J. Edinger Nats 33) WA Herbarium *sensu* APNI (2014).

*Podolepis* sp. Great Victoria Desert (A.S. George 8219) WA Herbarium *sensu* APNI (2014).

*Podolepis* sp. Wollunga Well (D.E. Albrecht 8794) NT Herbarium *sensu* APNI (2014).

Annual *herb* to 70 cm tall. *Stems* 1–several, ± erect, usually branched, woolly to cobwebbed below and near leaf axils, otherwise often glabrescent, brown

**Table 3.** A summary of the diagnostic characters of *Podolepis canescens* and similar species. Length and width measurements are abbreviated as L and W respectively.

| | *P. canescens* | *P. eremaea* | *P. remota* |
|---|---|---|---|
| **Leaf indumentum** | woolly below, sparsely woolly and often glabrescent above | woolly to cobwebbed below, less densely woolly above | woolly to cobwebbed below, less densely woolly above |
| **Basal leaf shape** | linear-oblanceolate | oblanceolate | linear |
| **Basal leaf size** | 50–80 mm L × 2–7 mm W | 30–120 mm L × 3–12 mm W | 20–50 mm L × 2–4 mm W |
| **Cauline leaf shape** | linear | linear-lanceolate | linear |
| **Cauline leaf size** | 10–50 mm L × 2–4 mm W | 10–100 mm L × 3–10 mm W | 10–50 mm L × 2–4 mm W |
| **Diameter of capitula** | 5–8(–10) mm | 5–10 mm | 10–15 mm |
| **Shape of intermediate involucral bract lamina** | ovate, base truncate to obtuse | ovate, base obtuse | broad-ovate to sub-orbicular |
| **Length of intermediate involucral bract lamina** | 1–2.5 mm | 2–3(–4) mm | 3–4 mm |
| **Apex of intermediate involucral bract lamina** | acute to acuminate | acute to acuminate | ±obtuse |
| **Surface of intermediate involucral bract lamina** | shallowly transversely rugose in apical half | virtually flat and smooth (often slightly wrinkled in dry specimens) | slightly concavo-convex |

or reddish. *Leaves* woolly to cobwebbed below, less densely woolly above, margins ± revolute, entire; basal leaves often withered at anthesis, few in a sparse rosette, usually oblanceolate, 3–12 cm long and 3–12 mm wide, petiolate, base amplexicaul, apex acute; cauline leaves alternate, sessile, stem-clasping, decurrent, usually linear-lanceolate, 1–10 cm long and 3–10(–20) mm wide, apex acute. *Peduncles* 1–4 cm long, with several scarious scale leaves below the involucre passing into the leafy stem. *Capitula* hemispherical, mostly 5–10 mm diam., many in loose cymes or corymbose panicles, rarely solitary. *Involucral bracts* many-seriate, overlapping loosely, with slender linear, glandular claws, clearly visible, unequal (outermost shortest, innermost longest); lamina scarious, straw-coloured, virtually flat (sometimes slightly wrinkled in dry specimens), smooth, shiny; intermediate bracts 4–8 mm long, apex acute to acuminate, claw c. 0.25 mm wide at the narrowest point, c. as long as lamina or longer, lamina 2–3(–4) mm long, ovate, base obtuse; inner bracts with claw much longer than lamina. *Florets* yellow; ray florets female, 20–30, ligules linear, 5–8 mm long, usually 3-toothed, teeth to 2 mm long, c. 0.5 mm wide; disc florets bisexual, numerous. *Cypselas* terete, c. 1.5 mm long, c. 0.5 mm wide, papillose; pappus bristles 15–20, barbellate, virtually free, 2–4 mm long. (Figs 1j, 11) Chromosome number: *n*=10.

***Selected specimens examined:*** **WESTERN AUSTRALIA.** Shark Bay, x.1877 (MEL 696457); Victoria Desert, 13.ix.1891, *R. Helms s.n.* (MEL 2160903); 1.5 km E of Queen Victoria Spring at Trap Site 2 in Queen Victoria Nature Reserve, 16.x.1995, *D.J. Edinger 976* (PERTH 4240480); 5.7 km S by track of Ilkurlka Roadhouse. Great Victoria Desert, 4.x.2010, *R. Davis 11585* (PERTH 8248532); Gullewa, Mugga Mugga Hill, approx. 56.8 km SW of Yalgoo, 26.ix.2006, *A. Markey 4956* (PERTH 7826230); Gibson Desert Eagle Camp Zone 6, ix.1992, *Desert Dreaming Expedition 42* (PERTH 3170233); 11 km W of Argus Corner, on PNC Hwy, 26.xi.1986, *D.J. Peerson 106* (PERTH 859923); 13 miles NW of Albion Downs woolshed, Eremean Province, 19.ix.1958, *N.H. Speck 1478* (CANB 108301). **NORTHERN TERRITORY.** Gibeanie paddock, 1 mile S of homestead, 25.viii.1955, *G. Chippendale 563* (MEL 2165624); Elkedra Station 23 km NW towards Hatches Creek, 10.viii.1979, *T.S. Hensholl 2755* (MEL 571315, DNA, CANB 290935); 10 km N of Aileron, 3.ix.1978, *J.R. Moconochie 2405* (MEL 575780, DNA, CANB 293752, MO, BRI, G); 8 miles E of Ayers Rock, 20.ix.1968, *A. Nicholls 980* (DNA 15335, MEL 2165625); 17 miles S of Mt Wedge Station, 19.ix.1956, *M. Lazarides 6061* (DNA 19068, MEL 2165622, CANB 108298, CANB 108299); 38 km SSW of Mt Olga, Foster Cliff Road, 7.ix.2009, *P.K. Latz 24846* (DNA 194256, AD, NT); Alywarr Desert, 29.x.1992, *D.J. Parsons 256* (DNA 89239, NT, MO); 45 km SW of Lake Neale-Amadeus Junction, 27.viii.1973, *J.R. Maconochie 1874* (DNA 8051); Alice Springs, 19.viii.1998, *C.R. Michell 1800* (DNA 135308, NT, DREF). **SOUTH AUSTRALIA.** 27 km NE from Pipalyatjara, 31.viii.1995, *P.J. Long & P.D. Canty BS23-25033* (AD 99642287); Flinders Ranges, Mawson Plateau, vii.1996, *R. Bates 42643* (AD 99841279); West end of Hopkins Lake, just south of Sir Frederick Range, 1.viii.1962, *D.E. Symon 2231* (AD 97545291); About 18 km NE of Mt Kintore summit, 10.ix.1978, *N.N. Donner 6645* (AD 97901072); Immediately north of Claude Hill, immediately south of Northern Territory border, 4.ix.1978, *N.N. Donner 6489* (AD 97847535); About 14 km by road NW of Krewinkel Hill, 3.ix.1978, *D.J.E. Whibley 6716* (AD 97845200); Between Deering Hills and Mann Ranges, c. 14.5 km NE of Mt Cooperinna, 8.ix.1978, *D.J.E. Whibley 6860* (AD 97844454); Lake Eyre. Finke River Track, 14 km E of Mt Dare, 14.v.2001, *R. Bates 58549* (AD 137001); Hill c. 4.5 km N of Kalka, 30.v.2000, *P.J. Long, P.D. Canty & A.C. Robinson BS23-30195* (AD 109597); Danggali Conservation Park. Five km N of turn off to Mulga Dam, 3.iii.1993, *D.D. Cunninghom 610* (AD 99317013).

***Distribution and habitat:*** Widespread across inland Western Australia, South Australia and the Northern Territory. Two isolated collections from eastern South Australia suggest it may occur in New South Wales. Found in mallee, chenopod scrubland, heathland and grassland. (Fig. 17b)

***Conservation status:*** Widespread, reasonably common and found in conservation reserves.

***Flowering period:*** Mostly August to October.

***Cytology:*** The chromosome number of *n*=10, was reported by Watanabe et al. (1999) as *Podolepis* sp. from *P.S. Short 4247*, which was selected as the type of *P. eremaea*.

***Notes:*** This species can be distinguished by the small capitula and tiny, virtually flat laminas on the intermediate involucral bracts that are often shorter than their claws. It is superficially similar to *P. canescens*, but the bracts are transversely rugose in that species. *Podolepis eremaea* could also be confused with *P. remota* but that species has more closely overlapping involucral bracts, and the laminas of the intermediate bracts are broad-ovate to sub-orbicular and usually more or less obtuse to acute at the apex.

***Etymology:*** From the Greek *erēmaios* = desert; in reference to the preferred habitat of this species.

**8. *Podolepis remota*** Jeanes, **sp. nov.**

***Type:*** **WESTERN AUSTRALIA.** About 20 km NE of Weelarrana Homestead on Jigalong Road, 29.viii.1995, *A.A. Mitchell PRP472* (holotype MEL 238350! (Fig. 12), isotype PERTH 4340078!).

Annual *herb* to 30 cm tall. *Stems* 1–several, ± erect, usually branched, woolly to cobwebbed below and near leaf axils, otherwise often glabrescent, brown or reddish. *Leaves* woolly to cobwebbed below, less densely woolly above, margins ± revolute, entire; basal leaves often withered at anthesis, few in a sparse rosette, usually ± linear, 2–5 cm long and 2–4 mm wide, petiolate, base amplexicaul, apex acute; cauline leaves alternate, sessile, stem-clasping, decurrent, ± linear, 1–5 cm long and 2–4 mm wide, apex acute. *Peduncles* 1–4 cm long, with several scarious scale leaves below the involucre passing into the leafy stem. *Capitula* hemispherical, mostly 10–15 mm diam., few to many in loose cymes or corymbose panicles, rarely solitary. *Involucral bracts* many-seriate, closely imbricate, completely covering the slender, linear, glandular claws, unequal (outermost shortest, innermost longest); lamina scarious, pale, slightly concavo-convex, shiny; intermediate bracts 4–8 mm long, apex ±obtuse to acute, claw c. 0.25 mm wide at the narrowest point, shorter or longer than lamina, lamina 2.5–4 mm long, broad-ovate to sub-orbicular, base obtuse; inner bracts with claw much longer than lamina, apex often acute to acuminate. *Florets* yellow; ray florets female, 20–30, ligules linear, 8–14 mm long, usually 3-toothed, teeth c. 1 mm long, c. 0.5 mm wide; disc florets bisexual, numerous. *Cypselas* terete, c. 1.5 mm long, c. 0.5 mm wide, papillose; pappus bristles 10–20, barbellate, virtually free, 3–4 mm long. (Figs 1k, 12)

***Specimens examined:*** **WESTERN AUSTRALIA.** 4 km SE of The Governor, 7.2 km SSW of Mt Robinson, 4 km NNE of Padtherung Hill, Hamersley Range, 15.viii.1992, *S. van Leeuwen 1282A* (PERTH 7507208); 4 km SE of The Governor, 4 km NNE of Padtherung Hill, 7.2 km SSW of Mt Robinson, Hamersley Range, 16.viii.1992, *S. van Leeuwen 1301* (PERTH 3057593); 220 km S of Newman, 6.x.1989, *B. Nordenstam & A. Anderberg 383* (PERTH 1690213); Cape Range Peninsula, beach 10 km N of Exmouth, Carnarvon Region, 2.x.1995, *S. Hunger & N. Kilian 4196* (PERTH 6723998); c. 30 km along the Blowholes/Dampier Salt Road from the North West Coastal Highway, 14.x.1983, *P.S. Short 2065* (MEL 1523260). **NORTHERN TERRITORY.** 8 km due S of Mt Samuel and c. 1 km N of NT/SA border, 3.ix.2009, *D.E. Albrecht 13058* (NT/DNA 213894); Track from Katajuta to Walytjatjata, c. 10 km due NE of Mt Le Hunte, 1.ix.2009, *D.E. Albrecht 12962* (NT 213893).

***Distribution and habitat:*** Widespread across inland Western Australia and the Northern Territory. Its occurrence in South Australia is anticipated as it has been collected about one kilometre north of the Northern Territory/South Australia border. Found in mallee, chenopod scrubland, heathland and grassland. (Fig. 17c)

***Conservation status:*** Probably reasonably common and well conserved, but poorly known and under-collected due to its remoteness and seasonality.

***Flowering period:*** Mostly August to October.

***Cytology:*** No data available.

***Notes:*** This species can be distinguished by the small capitula and the laminas on the involucral bracts that are somewhat concavo-convex and overlap tightly hiding the claws. The laminas of the intermediate involucral bracts are broad-ovate to sub-orbicular and are more or less obtuse to acute at the apex. *Podolepis eremaea* is similar in overall appearance, but it has slightly smaller capitula and loosely overlapping involucral bract laminas with the claws clearly visible. The involucral bract laminas are more or less flat (sometimes slightly wrinkled in dry specimens), ovate and acute to acuminate at the apex.

***Etymology:*** From the Latin *remota* = scattered, remote, distant; in reference to the distribution of this species.

**9. *Podolepis aristata*** Benth., *Enum. pl.* 64 (1837).

***Type:*** **WESTERN AUSTRALIA.** 'Swan River. (Hügel)', no location, no date, no collector (holotype, W 0047209, photo!); no location, no date, no collector (possible isotype, MEL 696477!).

Annual *herb* to 50 cm tall. *Stems* 1–several, decumbent or erect, unbranched or branched, woolly to cobwebbed below and near leaf axils, otherwise often glabrescent, brown or reddish. *Leaves* woolly to cobwebbed, less densely so above, margins flat to ± revolute, entire, sometimes undulate; basal leaves often withered at anthesis, few in a sparse rosette, usually oblanceolate, 3–12 cm long and 3–15 mm wide, petiolate, base amplexicaul, apex acute; cauline leaves alternate, sessile, stem-clasping, decurrent, usually linear-lanceolate, 1–12 cm long and 3–15 mm wide, apex acute. *Peduncles*

**Key to the subspecies of *Podolepis aristata***

1 Lamina of the intermediate involucral bracts more or less flat (sometimes slightly wrinkled in dry specimens) ..... 2
1: Lamina of the intermediate involucral bracts shallowly to deeply transversely rugose ..... 3
2 Apex of intermediate involucral bracts acuminate to aristate ..... 9a. *P. aristata* subsp. *aristata*
2: Apex of intermediate involucral bracts obtuse to acute ..... 9b. *P. aristata* subsp. *affinis*
3 Apex of intermediate involucral bracts acuminate to aristate ..... 9c. *P. aristata* subsp. *auriculata*
3: Apex of intermediate involucral bracts obtuse to acute ..... 9b. *P. aristata* subsp. *affinis*

1–6 cm long, with several scarious scale leaves below the involucre passing into the leafy stem. *Capitula* hemispherical, mostly 10–20(–25) mm diam., many in loose cymes, rarely solitary. *Involucral bracts* many-seriate, with slender linear, glandular claws, unequal (outermost shortest, intermediate longest); lamina scarious, straw-coloured to golden brown, virtually flat to deeply transversely rugose, shiny; intermediate bracts 6–12 mm long, apex obtuse, acute, acuminate or aristate, claw c. 0.25 mm wide at the narrowest point and shorter than the lamina, lamina 4–10 mm long, ±triangular, base truncate; inner bracts with claw longer than lamina. *Florets* yellow; ray florets female, 20–30, ligules linear, 10–20 mm long, 3(–5)-toothed, teeth to 3 mm long, 0.5–1 mm wide; disc florets bisexual, numerous. *Cypselas* terete, 1.5–2 mm long, c. 0.5 mm wide, papillose; pappus bristles 15–20, barbellate, virtually free, 4–8 mm long. Chromosome numbers: $n$=10, $2n$=20; $n$=11.

***Cytology:*** Chromosome numbers of $n$=10, $2n$=20 were reported by Turner (1967), Short (1986) and Watanabe et al. (1999) under the name *Podolepis canescens*. The voucher cited by Turner (*Turner 5422*) in this study corresponds to *P. aristata* subsp. *auriculata*, while voucher *Turner 5345* refers to *P. aristata* subsp. *aristata*. The voucher cited by Short (*Short 1271*) here refers to *P. aristata* subsp. *affinis*. Vouchers cited by Watanabe et al. (1999) as *Short 4421*, *Watanabe 159* and *Watanabe 355* here refer to *P. aristata* subsp. *affinis*, while *Short 4319* belongs to *P. aristata* subsp. *aristata* (all $n$=10). The chromosome number determination of $n$=11 reported by Turner (1967) under the name *P. auriculata*, voucher *Turner 5406*, here corresponds to *P. aristata* subsp. *auriculata*.

***Typification:*** In the protologue of *Podolepis aristata*, Bentham described the involucral bracts (*involucri squamis*) as '*acutissimis aristatis aureofuscis non rugosis*' meaning 'very acute, aristate, yellow-brown and not rugose'. The holotype is housed at the Vienna Herbarium (W). There is a possible syntype at MEL, from the Steetz herbarium, but this specimen lacks locality information and, although Hügel's name appears on the label, it is uncertain if he made the collection.

### 9a. *Podolepis aristata* subsp. *aristata*

*Podolepis chrysantha* Endl., *Bot. Zeitung (Berlin)* 1: 458 (1843); *Podolepis aristata* var. *chrysantha* (Endl.) Steetz, *Pl. Preiss.* 1(3): 466 (1845). *Type*: Western Australia. 'Nova Hollandia austro-occidentalis': Canning River, *Preiss 52* (syntype, MEL 696485!); Western Australia, *Preiss 52* (syntype, MEL 696433!).

*Podolepis subulata* Steetz, *Pl. Preiss.* 1(3): 465 (1845); *Podolepis canescens* A.Cunn. ex DC., f. *minor* Siebert & Voss *Vilm. Blumengärtn. ed. 3*, 1(1): 536 (1894). *Type*: Western Australia. 'In solo sublimoso districtus Vasse', xii.1839, *Preiss 54* (lectotype, S S-G-4947, here designated, photo! JSTOR Global Plants, isolectotypes, LD 1054916, photo! JSTOR Global Plants, MEL 242521!, MEL 696475!); 'In col. Swan River,' 1843, *Preiss 54* (syntype, G 301392, photo! JSTOR Global Plants).

*Podolepis aristata* Benth. var. *minor* Benth., *Fl. austral.* 3: 605 (1867). *Type*: Western Australia. 'Vasse river, Preiss, n. 54; between Moore and Murchison rivers, Drummond, 6th Coll. n. 155': Vasse River, no date, *Preiss 54* (syntypes, MEL 242521!, MEL 696475!); no location, no date, *J. Drummond 155* (syntype, MEL 2166262!).

Annual *herb* to 50 cm tall. *Involucral bracts* many-seriate, with slender linear, glandular claws, unequal (outermost shortest, intermediate longest); lamina scarious, straw-coloured, virtually flat (sometimes slightly wrinkled in dry specimens), shiny; intermediate bracts 7–12 mm long, apex long-acuminate or aristate, claw c. 0.25 mm wide at the narrowest point and shorter than the lamina, lamina 4–10 mm long, ± triangular, base truncate; inner bracts with claw longer than lamina. (Figs 1I, 13)

***Selected specimens examined:*** **WESTERN AUSTRALIA.** *In interior a sinu regis* George III (Inland, bay of King George III (King George Sound)), 8.xi.1840, *L. Preiss 60* (MEL 696434, MEL 696443); c. 15.5 km west of Mullewa along the road to Geraldton, 1.ix.1982, *P.S. Short 1603* (MEL 618683 (Fig. 13)); Bindoon Road, c. 2 km NE of Bullsbrook East, 25.x.1977, *J.H. Willis s.n.* (MEL 2118777); c. 10 km S of Three Springs on main road to Carnamah, 9.ix.1986, *P.S. Short 2810* (MEL 1555592, PERTH, AD, CANB); c. 3 km SW of Ardingly along road to Geraldton, 20.x.1983, *P.S. Short 2142* (MEL 1524324, PERTH); One mile south-west of Manmanning, 18.ix.1989, *B.H. Smith 1219* (MEL 1588721, PERTH, CBG 9204175, BRI, CHR, E); No. 2 Rabbit Proof Fence, c. 6 km SE of Kirwan, 18.ix.198S, *B.J. Conn 2227* (MEL 1586880, PERTH, NY, E); Kalbarri National Park, S of township between Red Bluff and park boundary, 21.ix.1982, *M.G. Corrick 8121* (MEL 644316); c. 18 km E of Jurien along main road to Brand Highway, 30.x.1995, *P.S. Short 4514* (MEL 2027979, PERTH, TI); Dingo Rock, 24.x.199S, *P.S. Short 4453* (MEL 2027918, TI); 14.8 km SW of Wongan Hills on Wilding Road, 15.x.1997, *J.A. Voganionce 153* (MEL 2146279); c. 2 km S of Binnu, 27.x.1995, *P.S. Short 4494* (MEL 2027959).

***Distribution and habitat:*** Confined to Western Australia where scattered between Esperance and Exmouth and found in a wide range of habitats including woodlands, open forests and mallee scrub. (Fig. 17d)

***Conservation status:*** Widespread, common and well represented in conservation reserves.

***Flowering period:*** Mostly August to November.

***Notes:*** This subspecies is apparently confined to Western Australia although some specimens of the subsp. *affinis* from South Australia (including the lectotype) with flat laminas on the involucral bracts could easily be mistaken for it. These specimens may have acute to shortly acuminate apices to the involucral bract laminas, but lack the aristate apices of subsp. *aristata*.

### 9b. *Podolepis aristata* subsp. *affinis* (Sond.) Jeanes, **comb. et stat. nov.**

***Basionym:*** *Podolepis affinis* Sond., *Linnaea* 25: 507 (1853); *Podolepis canescens* A.Cunn. ex DC. var. *affinis* (Sond.) F.Muell. & Tate, *Trans. & Proc. Roy. Soc. South Australia* 16: 366 (1896).

***Type:*** **SOUTH AUSTRALIA.** 'Murray. Port Lincoln. Dombey-bay (= Tumby Bay)': Dombey-bay, no date, *?J.F.C. Wilhelmi s.n.* (lectotype, MEL 696474!, here designated, isolectotype, MEL 696425!); Murray, no date, *F. Mueller s.n.* (residual syntypes, MEL 2160921!, MEL 2160924!, MEL 696466!, MEL 1517389!, MEL 2160878!, MEL 696461!, MEL 696464!, GH 11351 (four right-hand specimens only) photo! JSTOR Global Plants); Port Lincoln, no date, *?J.F.C. Wilhelmi s.n.* (residual syntypes, MEL 696476!, MEL 696463!).

*Podolepis canescens sensu* Lander (1987), Cooke (1986), Everett (1992) *p.p.*, Jeanes (1999) *non* A.Cunn. ex DC.

*Podolepis papillosa sensu* NW Victoria, x.1900, *C.Walter s.n.* (excluded syntype, LY, photo!) *non* Gand.

*Illustrations*: Grieve & Blackall (1975) p. 791; Cunningham et al. (1981) p. 664; Cooke (1986) fig. 710 A; Everett (1992) p. 264; Jeanes (1999) fig. 154d (all as *P. canescens*).

Annual *herb* to 40 cm tall. *Involucral bracts* many-seriate, with slender linear, glandular claws, unequal (outermost

**Table 4.** A summary of the diagnostic characters and distribution of the subspecies of *Podolepis aristata*

| | *P. aristata* subsp. *affinis* | *P. aristata* subsp. *aristata* | *P. aristata* subsp. *auriculata* |
|---|---|---|---|
| **Leaf indumentum** | woolly below, sparsely woolly and often glabrescent above | cobwebbed below, less densely cobwebbed above | woolly to cobwebbed below, less densely above |
| **Shape of intermediate involucral bract lamina** | ovate, base obtuse | ±triangular, base truncate | triangular to ovate, base truncate |
| **Apex of intermediate involucral bracts** | obtuse or acute to shortly acuminate | aristate | aristate |
| **Surface of intermediate involucral bracts** | virtually flat and smooth to deeply transversely rugose in apical half | virtually flat and smooth (often slightly wrinkled in dry specimens) | deeply to shallowly transversely rugose in apical half |
| **Distribution** | southern half of the continent from central Queensland to Shark Bay | Western Australia from Israelite Bay to Shark Bay | inland areas from central Queensland to Shark Bay |

shortest, intermediate longest); lamina scarious, straw-coloured to golden brown, almost flat (sometimes slightly wrinkled in dry specimens), or shallowly transversely rugose at least distally, shiny; intermediate bracts 6–12 mm long, apex acute or shortly acuminate, claw c. 0.25 mm wide at the narrowest point and shorter than the lamina, lamina 4–8(–10) mm long, lanceolate to ovate, base obtuse to truncate; inner bracts with claw longer than lamina. (Figs 1m, 1n, 14)

***Selected specimens examined:*** **WESTERN AUSTRALIA.** 6 km N of Wanarra Road turnoff to Perenjori along Great Northern Highway, 23.viii.1995, *P.S. Short 4175* (MEL 2027588, PERTH); Northern edge of Wargangering Rock, 21.x.1995, *P.S. Short 4421* (MEL 2027886); Wooramel River, 1889, *G.D. Robinson s.n.* (MEL 716821); Murchison River, 1892, *A. Weston s.n.* (MEL 716820); Eastern Highway between 58 miles west of Coolgardie and Southern Cross, 4.x.1961, *J.H. Willis s.n.* (MEL 2165634); Geraldton-Mt Magnet road, 24 miles E of Pindar, 10.ix.1966, *R.V. Smith 66/416* (MEL 1514574); Beside Northern Highway 63 km N of Paynes Find, 13.ix.1992, *M.G. Corrick 10946* (MEL 2014117); 180 km N of Leonora on road to Wiluna, 30.viii.1992, *M.G. Corrick 10872* (MEL 2014041); Tammin, 18.ix.1978, *R.J. Cronfield 585* (MEL 597794); 2.5 miles S of Wannoo, 16.ix.1968, *M.E. Phillips s.n.* (CBG 35781). **SOUTH AUSTRALIA.** Near Stuarts Range, 1885, *Winnecke s.n.* (MEL 696458); 1 km SW of homestead, Bulgunnia Station, 14.xi.1992, *F.J. Bodmon 6492* (MEL 2097980); Spencers Gulf (MEL 696417); Fowlers Bay, *Richords s.n.* (MEL 696422, MEL 716243); Clarendon, 1882, *O. Tepper s.n.* (MEL 696419); Yorke Peninsula, 1879, *O. Tepper 236, 282 & 450* (MEL 696426, MEL 696427, MEL 696415); Venus Bay, *J. Worburton s.n.* (696414); Near upper end of Spencers Gulf, 1887, *L. Wehl s.n.* (MEL 716846); Port Augusta, 1886, *J.P. Richords s.n.* (MEL 716558). **QUEENSLAND.** Milo Station, 13.2 km along track to Eight Mile Creek Catchment, NNW of Adavale, 5.viii.2009, *P.I. Forster 35533* (MEL 2340198); Caiwarro, Hungerford, Paroo, ix.1885, *J. Cotter s.n.* (MEL 696409, MEL 696468). **NEW SOUTH WALES.** Mossgiel, x.1885, *L. Brückner s.n.* (MEL 2160882); Murrumbidgee River, 1878, *G. Doy s.n.* (MEL 2160881); 26 km SE of Broken Hill on Menindee road, 30.viii.1981, *M.G. Corrick 7312* (MEL 591902, CANB 8309601); Booligal, Lachlan River, ix.1887, *A. Bell s.n.* (MEL 716826); Lachlan River, ix.1878, *F. Mueller s.n.* (MEL 696405); Bourke, Darling River, ix.1884, *L. Henry s.n.* (MEL 696411); Cockburn, viii.1921, *E.R. Reed s.n.* (AD 97828032); "Tandulya" c. 25 miles SE of Louth, 23.ix.1966, *C.W.E. Moore 4172* (CANB 177673); "Mulyah" Additional, about 43 km south of Louth, 24.ix.1978, *C.W.E. Moore 8009* (CANB 305494, CANB 305495). **VICTORIA.** 5 km SW of Sunset Tank and 30 km by road NNE of Cowangie, 3.x.1979, *M.G. Corrick 6406* (MEL 559433 (Fig. 14)); Wyperfeld National Park. Wonga Lake, 7.xi.1976, *A.C. Beauglehole 55286* (MEL 2160883); 5.2 km W of Mt Jenkins. Wirrengren Plain, near tank 1 km NE of Home Point, xi.1985, *D.M. Porkes s.n.* (MEL 1545175); c. 14 km north of Sunset Tank, 29.ix.1980, *P.S. Short 1165* (MEL 575573, CANB 298053, CANB 9218630); Underbool Tank area, 25.ix.1972, *A.C. Beauglehole 40450* (MEL 2160884); c. 50 km west of Ouyen, 3.x.1986, *C.E. & D.T. Woolcock s.n.* (MEL 1564875); Lake Rd, c. 200 m south of Meyers Rd, 8 km due N from Natimuk, 14.xi.2005, *N.G. Walsh 6343* (MEL 2275856); Sunset Plain, c. 16 km SW of Mt Crozier, 28.viii.1983, *R.J. Adair 2003* (MEL 238382); Near Murtoa, 3.x.1892, *F.M. Reader s.n.* (MEL 696397).

***Distribution and habitat:*** Scattered across semi-arid parts of southern Australia from central New South Wales and south-west Queensland to Shark Bay in Western Australia. Found in a range of habitats including mallee, chenopod scrubland and woodland. (Fig. 17e)

***Conservation status:*** Widespread, common and well represented in conservation reserves.

***Flowering period:*** Mostly August to November.

***Typification of* Podolepis affinis:** In the protologue of *Podolepis affinis*, Sonder described the involucral bracts (*involucri squamis*) as '*ovatus cuspidato-acuminatus subfusco-hyalinis planis*' meaning ovate, cuspidate to acuminate, pale brown to colourless and flat. Several apparent type specimens have been examined, and the involucral bracts range from almost flat (i.e. not rugose) in the 'Dombey (= Tumby) Bay' and 'Port Lincoln' specimens at MEL to deeply rugose in most of the 'Murray' specimens. Because the 'Dombey Bay' specimens most closely match the description in the protologue, one of these has been selected as the lectotype specimen. Although most of the 'Murray' syntypes have rugose involucral bract laminas, they appear to represent the same variable taxon as the lectotype.

***Notes:*** The degree of rugosity of the involucral bract laminas of *Podolepis affinis* varies considerably. Some plants, particularly from the western part of its range, have almost flat laminas whilst those from the east have generally deeply rugose ones, however this is not consistent. In some cases the degree of rugosity of the involucral bracts varies somewhat between capitula on the same plant, possibly related to maturity.

**9c. *Podolepis aristata* subsp. *auriculata* (DC.) Jeanes, comb. et stat. nov.**

***Basionym:*** *Podolepis auriculata* DC., *Prodr.* 6: 162 (1838).

***Type:*** **WESTERN AUSTRALIA.** *'In Novâ-Hollandiâ ad canum marinorum sinum legit cl. Gaudichaud et mecum comm.....(v.s.'*, Shark Bay, 1830, *M. Gaudichaud s.n.* (lectotype, G 1092, *fide* G.L. Davis (1957), photo!, MEL 2280346!, photo of lectotype).

*Podolepis pallida* Turcz., *Bull. Soc. Imp. Naturalistes Moscou* 24(2): 78 (1851). *Type*: Western Australia. 'Drum. coll. v. n. 387', *Nova Hollandia*, no date, *Drummond 387* (holotype, KW 1001501, photo! JSTOR Global Plants, isotypes, BM 810531 (three right-hand specimens only), G 301390, A 11354, GH 11353, photos! JSTOR Global Plants, MEL 2280273!, PERTH 1182498!).

*Podolepis canescens* var. *affinis sensu* F.Muell. & Tate *p.p.* (in respect to *Helms s.n.* (MEL 2165350!)) *non* (Sond.) F.Muell. & Tate.

*Podolepis canescens sensu* Jessop (1981) *non* A.Cunn ex DC.

*Illustrations:* Davis (1957) figs 58–64; Grieve & Blackall (1975) p. 791 (both as *P. auriculata*).

Annual *herb* to 50 cm tall. *Involucral bracts* many-seriate, with slender linear, glandular claws, unequal (outermost shortest, intermediate longest); lamina scarious, straw-coloured to golden brown, transversely rugose in distal half, rarely almost flat, shiny; intermediate bracts 7–12 mm long, apex aristate, claw c. 0.25 mm wide at the narrowest point and shorter than the lamina, lamina 5–10 mm long, ± triangular to ovate, base truncate; inner bracts with claw longer than lamina. (Figs 1o, 15)

***Selected specimens examined:*** **WESTERN AUSTRALIA.** c. 14 km SE of Carnarvon, along the North West Coastal Highway, 12.x.1983, *P.S. Short 2033* (MEL 1523259 (Fig. 15), PERTH, AD); Geraldton-Mt Magnet road, 1S mls E of Wurago & c. 66 mls E of Mullewa S, 10.ix.1966, *R.V. Smith 66/429* (MEL 1514572); 42 miles N of Gascoyne Junction, 24.viii.1965, *B.L. Turner S406* (MEL 602408); Shark Bay. 76 km W of Overlander Roadhouse on Denham Road, 30.x.1989, *B. Nordenstam & A. Anderberg 209* (MEL 1598544, S); c. 8 km S of Wooramel Roadhouse along NW Coastal Highway, 6.ix.1995, *P.S. Short 4344* (MEL 2027787, PERTH, AD, TI); Yaringa North Station, east side of Shark Bay, 8.viii.1964, *J. Galbroith WA233* (MEL 216S346); 100 miles S of Carnarvon, 26.viii.1965, *B.L. Turner 5422* (MEL 602788). **NORTHERN TERRITORY.** Walara, 11.x.1978, *E.A. Chesterfield s.n.* (MEL 2312459, MEL2312460); Ooraminna Range, 6.x.1993, *P.K. Latz 13417* (MEL 278961); 20 km S of Alice Springs on Old South Road, 11.viii.1988, *G. Leoch 2069* (MEL 29S327); Wallara Ranch road 13 km W of Stuart Highway at Meteorite Craters, 14.viii.1979, *A. Morton 273* (MEL 559434); c. 36 miles south of Alice Springs on sandplain south of Ooraminna Range, 5.viii.1979, *A. Morton 73* (MEL 151641S); 49 km along road to Kings Canyon (turn off from Lasseter Highway), 12.x.1996, *K. Wotonabe 679* (MEL 2034792, DNA, TI); 29 km E of Horseshoe Bend Homestead, 9.xi.1993, *P.K. Lotz 13493* (MEL 725492, DNA); George Gill Range, Penny Springs, 14.vii.1968, *A.C. Beauglehole 26789* (MEL 1578337); 2S km W of Henley Craters; Ernest Giles Road, 2S.viii.1998, *D.E. Albrecht 8784* (NT 96167). **SOUTH AUSTRALIA.** 18 m W of Welbourn Hill, W of Oodnadatta, 26.vi.1967, *A.C. Beouglehole 22742* (MEL 1S78546); 1S km S of NT border on Tarcoola-Alice Springs railway line, 20.viii.1979, *B. Lay 1237* (MEL 591157); Great Victoria Desert, N.C.S.S.A. Survey. 3 km E of Camp 5 and 3 km S along seismic line, 23.viii.1980, *C.R. Alcock 8174* (MEL 222436, AD); Koodnanie Creek, Birdsville Track, 30.ix.1960, *R. Filson 3307* (MEL 64604S); Mt Caroline, northwest Reserve, ix.1966, *H. Shirley 12* (DNA 22114); 85 km N of Tallaringa Well, 20.ix.1988, *A.C. Robinson S78* (DNA 56470, AD); 45 km NE of Welbourn Hill, 20.ix.1978, *J.C. Cordole s.n.* (CANB 278051); 46 km S of Kulgera along Stuart Highway, 4.viii.1988, *P.S. Short 3126* (MEL 11SS31). **QUEENSLAND.** 60 miles E of Quilpie, viii.1971, *M. Comeron s.n.* (DNA 33540); Stoneleigh Lease, northern section of Thylungra, 31.viii.2010, *J. Silcock JLS67S* (DNA 216437, BRI); Georgina River, 1889, *A. Henry s.n.* (MEL 716812, MEL 716225). **NEW SOUTH WALES.** Lake Cobham, ix.1887, *Bouerlen s.n.* (MEL 716206); From Duroodoo to Nangarna, 28.xii.1860, *Beckler s.n.* (MEL 696406).

***Distribution and habitat:*** Widespread across inland parts of Australia from Shark Bay to western New South Wales and south-western Queensland. Found in mallee, chenopod scrubland, heathland and grassland. (Fig. 17f)

***Conservation status:*** Widespread, common and well represented in conservation reserves.

***Flowering period:*** Mostly August to November.

***Notes:*** In most cases identified readily by the deeply transversely rugose involucral bract laminas that are aristate at the apex. Towards the eastern end of its range the involucral bracts on some specimens are less obviously aristate at the apex and the laminas less deeply rugose. These specimens can be difficult to differentiate from *Podolepis aristata* subsp. *affinis*.

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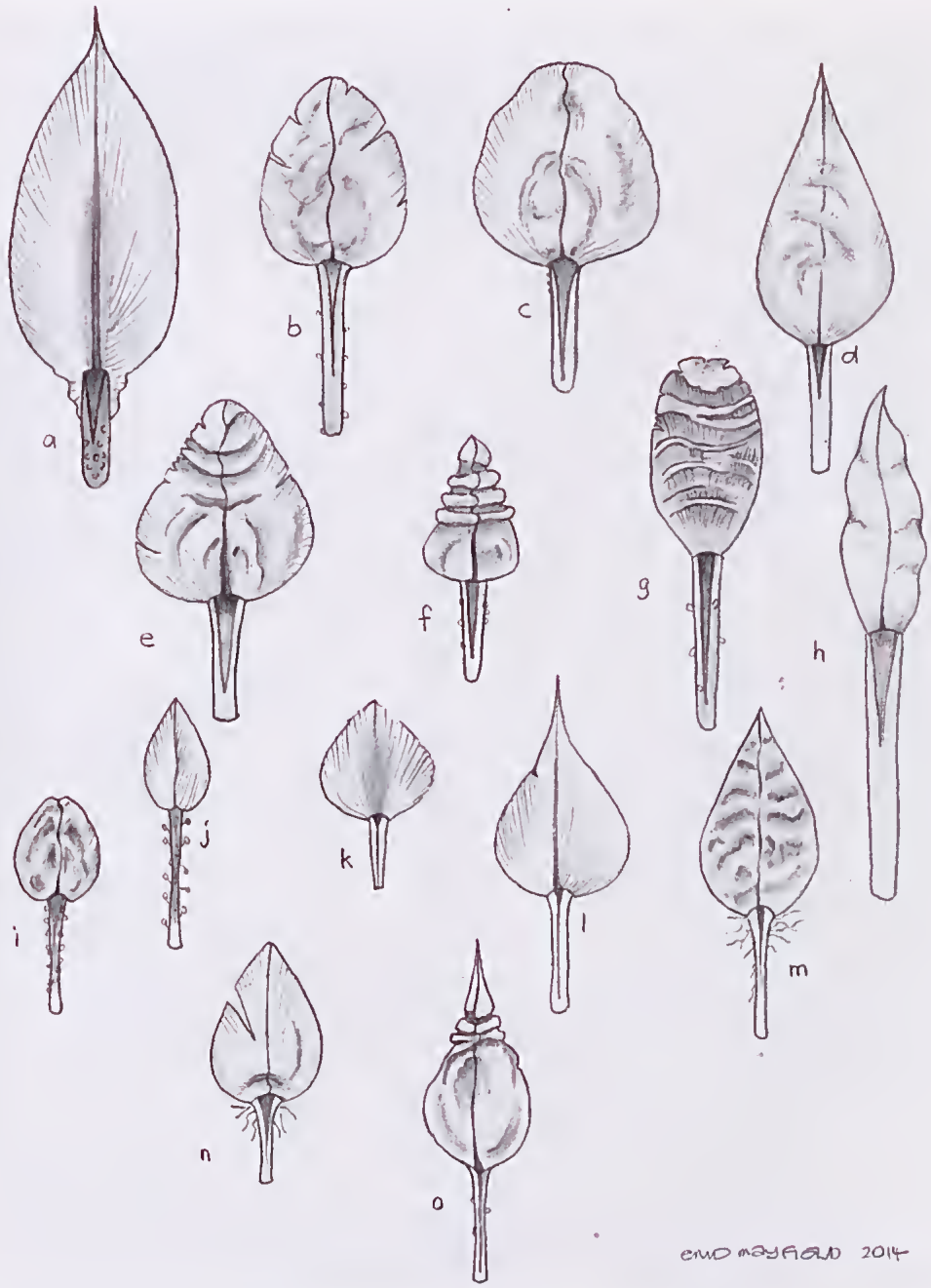


**Figure 1.** Intermediate invalucral bracts from dried herbarium specimens ×5 **a.** *Podolepis jaceaides*; **b.** *P. decipiens*; **c.** *P. laevigata*; **d.** *P. linearifolia*; **e.** *P. rugata* subsp. *rugata*; **f.** *P. rugata* subsp. *glabrata*; **g.** *P. rugata* subsp. *littoralis*; **h.** *P. rugata* subsp. *trullata*; **i.** *P. canescens*; **j.** *P.* eremaea; **k.** *P. remata*; **l.** *P. aristata* subsp. *aristata*; **m.** *P. aristata* subsp. *affinis* (transversely rugose); **n.** *P. aristata* subsp. *affinis* (mare ar less flat); **o.** *P. aristata* subsp. *auriculata*

CONFIRMAVIT
J.A. Jeanes
16/4/2013 Herb. MEL
L. HAEGI
002073
EX- NATIONAL HERBARIUM OF NEW SOUTH WALES
ROYAL BOTANIC GARDENS, SYDNEY
Podolepis jaceoides (Sims) Voss
Lat. 30 ° 53 'S Long. 144 ° 33 'E, Alt. m
Loc. Kallara Station: creek 4.5 km E of homestead along station track N.S.W.
Coll. L. Haegi 2073 Date 23.x.1981
Notes Creek on floodplain: localised lignum shrubland with grassy/herbaceous understorey. Black cracking clay. - Erect herb to 50 cm tall with taproot. Occasional, in patches. Flowers bright yellow; leaves somewhat fleshy. Fruiting heads nutant.
[Kallara H.S. is c. 160 km SW of Bourke, along Darling River].
MEL 617177
NATIONAL HERBARIUM OF VICTORIA (MEL), AUSTRALIA
copyright reserved

**Figure 2.** Representative specimen of *Podolepis jaceoides* (MEL 617177)

P. jaceoides
30
National Herbarium of Victoria (MEL)
Holotype of Podolepis decipiens Jeanes
Determinavit J.A. Jeanes 7/8/2013
MEL 606866
MEL606866
NATIONAL HERBARIUM OF VICTORIA (MEL)
MELBOURNE, AUSTRALIA
Podolepis jaceoides (Sims) Voss.
Loc.: VICTORIA—Western. S.W. of Mt. Langi Ghiran between Western Highway and railway line.
Lat. 37°19'30"S Long 143°04'E Grid J 13
Coll.: M.G. Corrick, no. 7528, 2.xi.1981.
Det.:
Notes: An open ground near railway line, burnt occasionally.
TYPE
NATIONAL HERBARIUM OF VICTORIA (MEL), AUSTRALIA
cm
0 1 2 3 4 5 6 7 8 9 10
copyright reserved
Royal Botanic Gardens Melbourne

**Figure 3.** Holotype of *Podolepis decipiens* (MEL 606866)

**Figure 4.** Lectotype of *Podolepis laevigata* (*F.M.Reader s.n.* LY 0000143).
Reproduced with permission of Université Claude Bernard, Lyon.

National Herbarium of Victoria (MEL)
Holotype of Podolepis linearifolia Jeanes
Determinavit: J.A. Jeanes 7/8/2013
NATIONAL HERBARIUM OF VICTORIA (MEL)
MELBOURNE, AUSTRALIA
MEL 2296546
319 ASTERACEAE
Podolepis sp 1 sensu FL Victoria 4:781 (1999)
Coll.: Jeanes, J.A. 1805 Date: 10 Dec 2007
Addit. Coll.: Turner, T
AUSTRALIA . VICTORIA
Region/District: Vic. Volcanic Plain
Locality: Old RAAF Base Laverton, northwest corner of base
Lat.: 37°51'50"S Long.: 144°44'02"E
Alt.: 25m Vic. Grid Ref.: N 50
Notes: Substrate: brown cracking clay derived from basalt. Native grassland. Associated species include: Taraxacum sp., Austrostipa sp., Convolvulus sp., Eryngium ovinum, Briza maxima, Romulea sp., Themeda triandra, Trifolium spp.
Thousands of plants in the general area, about 200 plants sampled for the Victorian Conservation Seedbank.
Det.: Jeanes, J.A. 10 Dec 2007
Dupls: K, CANB, NSW
TYPE
NATIONAL HERBARIUM OF VICTORIA (MEL), AUSTRALIA
cm
0 1 2 3 4 5 6 7 8 9 10
copyright reserved
Royal Botanic Gardens Melbourne

**Figure 5.** Holotype of *Podolepis linearifolia* (MEL 2296546)

Royal Botanic Gardens Melbourne
copyright reserved
0 1 2 3 4 5 6 7 8 9 10 cm
National Herbarium of Victoria (MEL)
Podolepis rugata Labill. var rugata
MELISR
Determinavit J.A. Jeanes 9/5/2013
NATIONAL HERBARIUM OF VICTORIA (MEL)
MELBOURNE, AUSTRALIA
MEL 2039182
319 ASTERACEAE
Podolepis sp.
Coll.: B. Archer 102 Date: 19 Sep 1995
AUSTRALIA :WESTERN AUSTRALIA
Region/District: Roe/Coolgardie
Locality: 7 km N of Mt Esmond; 172 km NE of Esperance.
Lat.: 33°16'16"S Long.: 123°37'44"E
Notes: Growing on a small plain in brown/grey sandy loam over limestone, Fringed by mallee woodland. Ass. spp. include Acacia sp., Fidotus sp., Scia sp., Westringia rigida, Olearia muelleriana.
Flowers golden yellow.
Growing in groups of 6-8. Scattered along edge of plain.
Dupls: PERTH
National Herbarium of Victoria (MEL)
Podolepis rugata Labill. subsp rugata
Determinavit: J.A. Jeanes 26 May 2014
NATIONAL HERBARIUM OF VICTORIA (MEL), AUSTRALIA

**Figure 6.** Representative specimen of *Podolepis rugata* subsp. *rugata* (MEL 2039182)

Royal Botanic Gardens Melbourne
copyright reserved
0 1 2 3 4 5 6 7 8 9 10
cm
National Herbarium of Victoria (MEL)
Podolepis rugata Labill. subsp glabrata Jeanes
HOLOTYPE
Determinavit: J.A. Jeanes 26 May 2014
NATIONAL HERBARIUM OF VICTORIA (MEL)
MELBOURNE, AUSTRALIA
MEL 2356596
Podolepis rugata Labill. var. rugata
Det.: Jeanes, J.A., 1 Dec. 2011
Coll.: Joanes, J.A. 2744 Date: 24 Nov. 2011
Addit. Coll.: Ryan, J.; Barnes, H
Collecting trip: National Herbarium of Victoria Field Trip 2011 (22-25 Nov. 2011).
Australia: Victoria
Loc.: Murray-Sunset National Park. Near the intersection of Nowingi Lino Track and Rocket Lake Track. 34° 39' 34" S 141° 49' 39" E. Alt.: 54 m.
Habitat: Dune mallee scrub on pale brown sand.
Associated taxa: Westringia rigida, Halgania cyanea, Triodia scariosa, Thysanotus baueri, Lepidosperma sp., Lomandra leucocephala, Schoenus subaphyllus, Codonocarpus cotinifolius, Amphipogon caricinus, Cyphanthera myosotidea, Olearia passerinoides.
Descriptive notes: Erect herb to 40 cm tall. Ray florets yellow.
Collecting notes: Scattered plants.
Dupl.: CANB, S, PAL
Main collection (D Droits - 319 Asteraceae (S Australasia)
Printed from MELISR, 10 Jan. 2012
TYPE
NATIONAL HERBARIUM OF VICTORIA (MEL), AUSTRALIA

**Figure 7.** Holotype of *Podolepis rugata* subsp. *glabrata* (MEL 2356596)

**Figure 8.** Representative specimen of *Podolepis rugata* subsp. *littoralis* (MEL 716242)

cm 0 1 2 3 4 5 6 7 8 9 10
copyright reserved
Royal Botanic Gardens Melbourne
National Herbarium of Victoria (MEL)
Podolepis rugata Labill. subsp trullata Jeanes
ISOTYPE
Determinavit: J.A. Jeanes 26/5/2014
MEL 2366399
Ex STATE HERBARIUM OF SOUTH AUSTRALIA (AD)
Compositae / AD197477
Podolepis jaceoides (Sims)W.Voss
det. D.E. Symon, 7 Nov 2006
South Australia, Region 10: Yorke Peninsula.
Road to Cape Spencer Lighthouse, SE side of road. Innes National Park.
Coord. ex gridref. 35°17'44"S, 136°53'04"E; precn 0.5
Not common. Sand dunes (low). Very exposed, windy hills/sand dunes. Low scrub - medium. Amongst and growing out of other low bushes.
Beautiful bright yellow large daisy. Large flat white or yellow centre with many narrow petals on outside flower, sits on a large green 'scaly' cup with small - tiny segments sticking out. Grows on a tall rigid stem with large partly succulent leaves in middle. Stem is thick and rough at bottom half with very short root system.
T. Jaques INP-296 & T. Lewis
11 Sep 2006
Duplicates to: MEL
Databased in: ADHERB (jhansen; geoc.OK)
INP296
TYPE
NATIONAL HERBARIUM OF VICTORIA (MEL), AUSTRALIA

**Figure 9.** Isotype of *Podolepis rugata* subsp. *trullata* (MEL 2366399)

R.J 1711
Podolepis
? muelleri
National Herbarium of Victoria (MEL)
Podolepis canescens A Cunn ex DC
Conf:
Determined J.A. Jeanes 26/5/2014
MEL 2264178
EX
NATIONAL HERBARIUM OF NEW SOUTH WALES (NSW)
Royal Botanic Gardens, Sydney
Podolepis canescens A.Cunn. ex DC.
Det.: B.M. Wiecek 20 Feb 2006
ASTERACEAE
Loc.: 1.9 km west of Glen Alice on road towards Rylstone.
AUSTRALIA NSW Central Coast Tablelands
Lat. 33° 02'26"S Long. 150° 11'47"E Alt.: 310 m.
Coll.: R. Johnstone 1711 & A.E. Orme
Date: 15 Dec 2005
Notes: Gently undulating country, mostly cleared for agriculture. Remnant open forest, particularly along roadside, with Eucalyptus melliodora, E. sideroxylon, Acacia montana, Chrysocephalum sp., grasses etc. Pale brown sandy/rocky soil over sandstone.
Locally frequent forb 40 cm x 25 cm. Flowers yellow. Fruits pale tan. Seeds collected from > 50 plants. Collected for Millennium Seed Bank Project.
Dups. to: K, MEL
(This specimen is a duplicate of NSW 493723)
NATIONAL HERBARIUM OF VICTORIA (MEL), AUSTRALIA
copyright reserved
cm

**Figure 10.** Representative specimen of *Podolepis canescens* (MEL 2264178)

cm
0 1 2 3 4 5 6 7 8 9 10
copyright reserved
Royal Botanic Gardens Melbourne
National Herbarium of Victoria (MEL)
Holotype of Podolepis eremaea Jeanes
Determinavit: J.A. Jeanes 7/8/2013
NATIONAL HERBARIUM OF VICTORIA (MEL)
MELBOURNE, AUSTRALIA
MEL 2027659
319 ASTERACEAE
Podolepis sp.
Coll.: P.S. Short 4247 Date: 27 Aug 1995
AUSTRALIA :WESTERN AUSTRALIA
Locality: Ashburton Botanical District. Rocky slope c. 17 km SW of Kumarina.
Lat.: 24°49'30"S Long.: 119°30'35"E
Notes: Growing in tall Acacia shrubland with spinifex common in understorey. Red-brown sandy loam. Erect herbs to c. 70 cm tall. All florets yellow.
Dupls: AD, BRI, CANB, K, NSW, PERTH, S, TI
4247
TYPE
NATIONAL HERBARIUM OF VICTORIA (MEL), AUSTRALIA

**Figure 11.** Holotype of *Podolepis eremaea* (MEL 2027659)

cm
0 1 2 3 4 5 6 7 8 9 10
copyright reserved
Royal Botanic Gardens Melbourne
National Herbarium of Victoria (MEL)
Podolepis remota Jeanes
HOLOTYPE
Determinavit J.A. Jeanes 26|5|2004
MEL 238350
WESTERN AUSTRALIAN HERBARIUM, PERTH
Voucher for Pilbara Ranges Project
#6 Podolepis canescens
Upright annual herb with yellow flowers growing up to 0.2m tall Common
Acacia sclerosperma shrubland with Triodia longiceps understorey
Calcrete rise
Location : About 20km NE of Weelarrana Nod on Jigalong road
Lat. 23°51'06"S Long. 120°10'36"E
Coll: A.A. Mitchell PRP472 Date: 29th August, 1995
Voucher For : Western Australian Herbarium
Duplicates : PILBARA MITCHELLIANUM
TYPE
MEL238350
NATIONAL HERBARIUM OF VICTORIA (MEL), AUSTRALIA

**Figure 12.** Holotype of *Podolepis remota* (MEL 238350)

Royal Botanic Gardens Melbourne
copyright reserved
0 1 2 3 4 5 6 7 8 9 10 cm
National Herbarium of Victoria (MEL)
Podolepis aristata Benth. subsp aristata
Determinavit: J.A. Jeanes 26/5/2014
MEL 618683
1603
NATIONAL HERBARIUM OF VICTORIA (MEL)
MELBOURNE, AUSTRALIA
Podolepis canescens Cunn. ex DC.
Loc.: Western Australia. c.15.5 km west of Mullewa along the road to Geraldton.
Lat c.28°36'S Long 115°25'E
Coll.: P.S.Short 1603 1.ix.1982
Det.:
Notes: Herb, major axes erect. Florets yellow.
Habitat: Mallee eucalypt-Acacia scrub.
Red-brown loam.
NATIONAL HERBARIUM OF VICTORIA (MEL), AUSTRALIA

**Figure 13.** Representative specimen of *Podolepis aristata* subsp. *aristata* (MEL 618683)

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MEL 559433
ROYAL BOTANIC GARDENS
AND
NATIONAL HERBARIUM, MELBOURNE
VICTORIA, AUSTRALIA
Podolepis canescens A.Cunn. ex DC.
Loc.. VICTORIA North.-west. Grid A.46.
Sunset Country; 5 km S.W. of Sunset Tank
& 30 km by road NNE of Cowangie.
141° 28' E; 34° 59' S.
Coll.. F.G.Corrick 6406, 3 Oct. 1979.
Det.:
Notes. On grassy, open plain adjoining
mallee sand hills. Flowers yellow.
National Herbarium of Victoria (MEL)
Podolepis aristata Benth. subsp affinis
(Sond.) Jeanes
Determinavit: J.A. Jeanes 26/5/2014
NATIONAL HERBARIUM OF
VICTORIA (MEL), AUSTRALIA
VICTORIA PLANT MAPPING GRID

**Figure 14.** Representative specimen of *Podolepis aristata* subsp. *affinis* (MEL 559433)

National Herbarium of Victoria (MEL)
Podolepis aristata Benth. subsp auriculata
(DC.) Jeanes
Determinavit J A Jeanes 26/5/2014
auriculata
NATIONAL HERBARIUM OF
VICTORIA (MEL), AUSTRALIA
MEL 1523259
MEL1523259
NATIONAL HERBARIUM OF VICTORIA (MEL)
MELBOURNE AUSTRALIA
COMPOSITAE (ASTERACEAE)
Podolepis auriculata DC.
Loc.: WESTERN AUSTRALIA: c. 14 km. south east of Carnarvon, along the North West Coastal Highway.
Lat. 24°57'S Long. 113°44'E
Coll.: P.S. Short, no. 2033, 12th October 1983
Det.:
Notes: Red sand dune dominated by shrubs of Acacia. Major aces ascending. All florets yellow.
Dupl.: PERTH, AD.
copyright reserved
cm

**Figure 15.** Representative specimen of *Podolepis aristata* subsp. *auriculata* (MEL 1523259)

**Figure 16.** Distribution of **a.** *Padolepis jaceaides*; **b.** *P. decipiens*; **c.** *P. laevigata*; **d.** *P. linearifalia*; **e.** *P. rugata* subsp. *rugata*; **f.** *P. rugata* subsp. *glabrata*; **g.** *P. rugata* subsp. *littaralis*; **h.** *P. rugata* subsp. *trullata*

**Figure 17.** Distribution of **a.** *Podolepis canescens*; **b.** *P. eremaea*; **c.** *P. remota*; **d.** *P. aristata* subsp. *aristata*; **e.** *P. aristata* subsp. *affinis*; **f.** *P. aristata* subsp. *auriculata*

Muelleria

33: 61–65

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# Description of a new species allied to *Podolepis robusta* (Asteraceae: Gnaphalieae) from the south-eastern Australian Alps

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## Introduction

During field work in the mountains of north-east Victoria, it became apparent that populations previously referred to *Podolepis robusta* (Maiden & Betche) J.H.Willis included several forms, initially apparent through colour and size of flowering heads and character of foliar pubescence, one of which appears to have been reduced to local rarity on the Bogong High Plains, at least in part through the impacts of cattle grazing (pers. obs.). Further investigation of this variation indicated the existence of a clearly distinguishable additional species, which is described here as *P. laciniata* Frood. In examining specimens of *P. robusta* from CANB, MEL and NSW, a range of variation was observed that may warrant recognition of several additional subspecies, however further field work is required to reliably confirm the distinctiveness of these. In the interim, a generalised description of *P. robusta* is provided.

## Terminology

Terminology herein follows that of recently published treatments of *Podolepis* Labill. (e.g. Everett 1992; Jeanes 1999; Jeanes 2015) so that differences between taxa may more readily be discerned. In particular, 'intermediate bracts' refer to those approximately midway between the basal and most distal bracts of the involucre. The 'claw' is the narrow, non-membranous section proximal to the expanded, thinner-textured lamina. Measurements have been taken from dried herbarium specimens.

## Abstract

*Podolepis laciniata* Frood, a segregate from *P. robusta* (Maiden & Betche) J.H.Willis, is newly described and illustrated, with notes on its distribution and habitat. Variation in *P. robusta* is briefly discussed.

***Key words:*** *laciniata*, Bogong, cattle, alps, grazing

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## Taxonomy

### 1. *Podolepis laciniata* Frood, sp. nov.

***Type:*** **VICTORIA.** West of Buckety Plains, near Lunch Saddle, adjacent to Cope Road, Bogong High Plains, 16.ii.1982, *R.J. Adair 1627* (holo: MEL 1556015A; iso: CANB 8905062, NSW 421229).

*Podolepis* sp. aff. *robusta* (N.E. Alps) *sensu* Walsh & Stajsic (2007), pp. 61, 248.

*Podolepis* sp. N.E. Alps (N.G.Walsh 5964) Vic. Herbarium *sensu* CHAH (2011).

*Perennial herb* to c. 70 cm high, with multiple shoots arising from basal rosette. *Taproot* stout. *Basal leaves* narrowly oblanceolate, with acute to narrowly obtuse apex, 6–28 cm long, mostly 1.8–5.0 cm wide, greyish when young, with short, crisped multicellular hairs overlain by fine arachnoid hairs, the latter usually denser on the abaxial surface, becoming sparser with age. Cauline leaves with similar pubescence to the basal ones but often more densely indumented. *Conflorescence* a loosely corymbose panicle, almost flat-topped at maturity, with 3–17 capitula. *Peduncles* elongating, (6–) 14–18 cm long at anthesis, with 1–several reduced leaf-like bracts, grading into hyaline outer involucral bracts. *Capitula* clear yellow when fresh, mature capitula 30–50(–55) mm diameter. Claw of intermediate *involucral bracts* usually 1.5–2.0 mm wide (rarely narrower), c. 7–11 mm length, with honey-coloured crisped and glandular pubescence of variable length, but mostly 0.2–0.3(–0.5) mm long. Lamina of intermediate involucral bracts broadly ovate to reniform, c. 5–7 mm wide, c. 6–10 mm long. *Ligulate florets* 14–20 mm long (from base of pappus to apex), c. 3.0–4.5 mm wide, apex deeply incised into 3–5 lobes c. 2.0–4.5 mm long, rarely with secondary lobing. *Tubular florets* 9–12 mm long, with corolla lobes 1–2 mm long. *Pappus bristles* c. 6–8 mm long, barbellate-plumose with hairs to c. 0.2 mm long. Mature *cypselas* scabrid to papillose, at least in upper portion, 3.0–4.5 mm long. (Figs 1a, 2)

*Selected specimens (from c. 65) examined:* **NEW SOUTH WALES.** Cascade Trail, near Dead Horse Gap, Snowy Mountains, 27.ii.1971, *J.I. Raine ANU 10350* (CANB, NSW); Dead Horse Gap (Alpine Way), c. south of Mt Kosciuszko, 8.i.1959, *N.C. Ford s.n.* (NSW 47036); Gold Seeker Track near Kiandra, 12.ii.1996, *M. Ito 96093* (MEL, NSW). **AUSTRALIAN CAPITAL TERRITORY.** Between Mts Ginini and Little Ginini, Brindabella Range, 30.i.1975, *P. Ollerenshaw PO/1510* (CANB); Summit of Mt. Gingera, Cotter River District, 28.ii.1962, *R.D. Hoogland 8470* (NSW). **VICTORIA.** Sun Valley, 1.1 km north-west of water tower in west arm of Rocky Valley Storage Dam, Bogong High Plains, 22.ii.1982, *R.J. Adair 1608* (MEL, CANB); Approx. 6 km south-east of Hotham Village on Omeo Road, 25.i.1981, *M.G. Corrick 7134* (CANB, MEL); Wombargo Track about 15 miles [24 km] in from Suggan Buggan Road towards Limestone Creek, 9.iii.1966, *E.J. Carroll s.n.* (CBG 17470); The Playgrounds, 2.5 km SW of Mt Cobberas No. 1, 21.i.1982, *N.G. Walsh 856* (MEL, NSW); 'Diggers Holes', Nunniong, S.i.1949, *N.A. Wakefield 2636* (MEL).

***Distribution and habitat:*** Apparently restricted to the Australian Alps Biogeographic Region (Commonwealth of Australia 2012) where recorded from the Snowy Mountains in Kosciuszko National Park in New South Wales (e.g. Dead Horse Gap, Mt Jagungal, Kiandra area, Yarrongobilly), extending north to the Brindabella Range in the Australian Capital Territory and south-west through the Cobberas to Mt Hotham and the Bogong High Plains in Victoria.

The species appears to favour open, grassy habitats around treelines (typically *Eucalyptus pauciflora* Sieber ex Spreng.), either at the true upper limit or on the edge of inverted treelines associated with cold air drainage. Altitude range c. 1200–1700 m.

***Etymology:*** The epithet refers to the deeply lacerated apex of the ligules of the outer florets, in comparison to the relatively shallowly lobed ligulate florets of *Podolepis robusta*.

***Notes:*** *Podolepis laciniata* differs from *P. robusta* in its substantially larger, more deeply dissected ligules; the presence (and usually abundance) of crisped hairs on the basal foliage; broader involucral claws and larger

**Key to *Podolepis laciniata* and *P. robusta***

1 Ligulate florets yellow, 14–20 mm long (from base of pappus), apex deeply divided into 3–5 lobes, 2–4.5 mm long (rarely with secondary lobing); crisped hairs usually conspicuous on mature basal leaves; claw of involucral bract typically c. 1.5–2.0 mm wide; mature cypsela 3.0–4.5 mm long ..... **1. *P. laciniata***

1: Ligulate florets yellow to orange, 9–13 mm long, apex with 3–5 teeth to 2 mm long; crisped hairs absent from leaf surfaces (rarely a few present on leaf margins); claw of involucral bract c. 1.0 mm wide; mature cypsela 2.5–3.0 mm long ..... **2. *P. robusta***

laminae; longer tubular florets; larger cypselas and broader capitula.

The leaves of one specimen (*E. Gauba* s.n. NSW 125981) from Mt Gingera in the Australian Capital Territory are woollier than usual, superficially resembling the lanuginose variant of *P. robusta* (discussed below) whereas two specimens (*E.J. McBarron 12145* (NSW); *H. Salasoo 3741* (NSW)) have almost glabrous basal leaves. Both of these deviations from the usually distinctive appearance of *P. laciniata* retain the characteristic larger, deeply dissected ligules and, although sparse, crisped hairs on the leaves. It is possible that these specimens are of hybrid origin.

**2. *Podolepis robusta*** (Maiden & Betche) J.H.Willis, *Vict. Naturalist* 70: 224 (1954)

*Podolepis acuminata* R.Br. var. *robusta* (Maiden & Betche) J.H.Willis, *Vict. Naturalist* 59: 120 (1942); *Podolepis longipedata* var. *robusta* Maiden & Betche, *Proc. Linn. Soc. New South Wales*, ser.2, 23: 12 (1898).

***Type:*** **NEW SOUTH WALES.** Kiandra district, Feb. 1897, *E. Betche* s.n. (lectotype MEL 727578; isolectotype NSW), *fide* J.H. Willis, *Vict. Naturalist* 70: 224 (1954).

*Perennial herb*, to 80 (rarely to 100) cm high, with multiple shoots arising from basal rosette. *Taproot* stout. *Basal leaves* oblanceolate, 4–20 cm long, 1.5–5.5 cm wide, with obtuse to broadly acute apex, glabrous, light green, rarely moderately to densely white-woolly, stems and cauline leaves with woolly indumentum. *Conflorescence* narrow to loosely corymbose panicles, with 3–11 capitula. *Peduncles* variously elongating, with 0–2 deciduous to persistent woolly *bracts* to 10 mm long and sometimes several additional hyaline appendages which grade into the involucral bracts towards the base of the capitula. *Capitula* clear yellow to orange when fresh, mature capitula 25–35(–40) mm diameter. *Claw* of intermediate *involucral bracts* c. 1 mm wide, to 5(–10) mm long, with pale brown to purplish glandular hairs <0.5 mm long (especially in lower section). *Lamina* of intermediate involucral bracts ovate, c. 3.5–5.0 mm wide and 5–8 mm long. *Ligulate florets* 9–13 mm long (from base of pappus to apex), c. 2.0–3.0 mm wide; apex toothed, with 3–5 teeth c. 0.7–2.0 mm long. *Tubular florets* 6–10 mm long, with corolla lobes usually 0.5–1.2 mm long (2.0–2.5 mm long in woolly-leaved variant). *Pappus* bristles c. 4.0–8.5 mm in length, barbellate with teeth c. 0.1(–0.2) mm long. *Cypselas* sparsely scabrid in

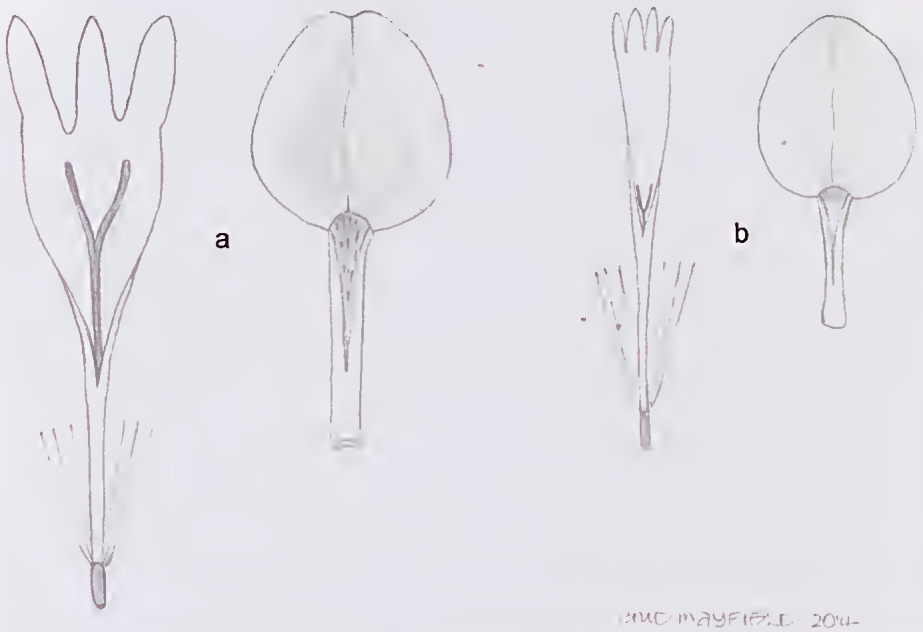


**Figure 1.** Ligulate florets and intermediate involucral bracts of **a.** *Podolepis laciniata* (*N.G.Walsh 5964* (MEL)) and **b.** *P. robusta* (*N.G.Walsh 5970* (MEL))

upper part, 2.5–3.0 mm long. (Figs 1b, 3). *Alpine Podolepis, Cattleman's Lettuce, Mountain Lettuce.*

***Selected specimens (from c. 16S) examined:*** **NEW SOUTH WALES.** 6 miles [10 km] east of Kiandra, 26.ii.1952, *N.T. Burbidge 3805* (CANB); Approx. 300 m from Charlottes Pass on track to Blue Lake, Kosciusko National Park, 15.iii.1977, *D. Verdon 2649, B. Bornsley & D. Young* (CANB); Schlink Pass Road, Spur above descent to Geehi, Kosciusko National Park, 30.i.1964, *M.E. Phillips s.n.* (CBG 41240); 3.2 km from Grey Mare Track turnoff, along Happy Jacks Road, towards Happy Jacks Pondage, Snowy Mountains, 17.i.1966, *E.J. Carrol 126* (CANB); One mile [1.6 km] from Beacon Hill Track towards Happys Hut, Happy Jacks Plains, Snowy Mountains, 20.i.1966, *E.M. Canning s.n.* (CBG 14455). **AUSTRALIAN CAPITAL TERRITORY.** Between Pryors Hut and Mt Ginini, Brindabella Range, 19.i.1983, *R. Coveny 11541 & P. Hind* (CANB); Ginini Flats just north of Mt Ginini, 11.ii.197S, *T.A. Hallidoy 318* (CANB). **VICTORIA.** Snow plain at base of Mt McLeod, Mt Buffalo National Park, 27.i.1982, *P.S. Short 1385* (CANB, MEL); Snowy Plains, 1.ii.1982, *E.A. Chesterfield 1603* (MEL); Lost Plain, 44 km NE of Licola, 7.iii.1993, *P.C. Jobson 1993* (MEL); Mt Buller, between peak and Little Mt Buller, 29.i.1983, *C.W. Higgins 71* (MEL); Mt Stirling, near summit, 30.i.1982, *M.G. Corrick 7948* (MEL).

***Distribution and habitat:*** Reasonably common and widespread throughout the Australian Alps Biogeographic Region (Commonwealth of Australia 2012), from Mt Ginini (Namadgi National Park, Australian Capital Territory), through the Snowy Mountains (New South Wales) and virtually throughout the Victorian alps and subalps as far south as the Baw Baw Plateau.

*Podolepis robusta* usually occurs above the (*Eucalyptus pauciflora*) treeline (or below where the treeline is

**Figure 2.** *Podolepis locinioto*, Big River Fire Trail, Bogong High Plains, Victoria (photograph N. Walsh)

inverted in cold-air drainage hollows). It typically occurs in subalpine/alpine grassland and open heathland. Where *P. robusta* and *P. laciniata* are ± sympatric, *P. robusta* will nearly always be found at higher elevations but, in a few instances, the two may occur in mixed populations. Altitude range c. 1200–1920 m.

***Notes:*** While the typical form of the species has bright green, glabrous leaves, loosely corymbose conflorescences and capitula with yellow florets, there is considerable variation, some at least having a geographic pattern. A variant with lanuginose leaves occurs in the Brindabella Range, Australian Capital Territory. Plants with generally shorter florets occur on the Baw Baw Plateau, Victoria, and plants with narrowly paniculate conflorescences, the shortly pedunculate capitula often with orange-yellow florets, have been collected on the Bogong High Plains, Victoria. Some of this variability may be a consequence of hybridisation between the two species treated herein. Specimens from CANB and NSW on loan to MEL were determined with provisional infraspecific names for some of these variants. Subsequent reassessment of the variation within *Podolepis robusta*, as described above, suggests that formal recognition of these variants was premature and further research is needed to understand fully the nature and origin of the variation.

## Acknowledgements

It is a pleasure to acknowledge the assistance of the staff of the National Herbarium of Victoria at the Royal Botanical Gardens Melbourne, in particular Neville Walsh and Catherine Gallagher. Staff at CANB and NSW are thanked for the prompt preparation of loans. I also thank Enid Mayfield (MEL) for the fine drawing of florets and bracts and Geoff Lay (MEL) for the photograph of *Podolepis robusta*.

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**Figure 3.** *Podolepis robusta*, Mt Nelse, Bogong High Plains, Victoria (photograph G. Lay)

Muelleria

33: 67–73

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# *Eucalyptus ambigua* is not the correct name for the Smithton Peppermint of Tasmania

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## Introduction

The Tasmanian endemic tree known as Black Peppermint, *Eucalyptus amygdalina* Labill., was described by J.J.H. de Labillardière (1806) from material he collected in Tasmania during the D'Entrecasteaux expedition in 1792 or 1793. Material also gathered by Labillardière during the same voyage was used by A.P. de Candolle (1828) to describe *E. ambigua* DC. (Bean 2009). Subsequently, J.D. Hooker (1856) described *E. nitida* Hook.f. from material collected by R.C. Gunn and, in the same year, F.A.W. Miquel (1856) described *E. tenuiramis* Miq. from material collected by Charles Stuart. Bentham (1867) used a broader concept of *E. amygdalina*, and treated *E. tenuiramis* as a synonym of this name, as well as treating both *E. nitida* and *E. ambigua* as synonyms of *E. amygdalina* var. *nitida* (Hook.f.) Benth. Maiden (1905) agreed with Bentham on the taxonomic identity of *E. ambigua*, but also considered the possibility that it might instead be *E. stricta* Sieber ex Spreng. Blakely (1934) took this further in his *A key to the Eucalypts* and simply treated *E. ambigua* as a synonym of *E. stricta*. Bean (2009) explains that this is incorrect, on account of the specimens referred to not constituting type material.

Bean (2009) examined specimens of *E. ambigua* collected by Labillardière and held at G and G-DC, and designated G00131709 as its lectotype, a specimen that consists of two sheets, one of which is sterile, while the second contains mature fruit (Fig. 1). He concluded that the type is conspecific with *E. nitida* and, since the name *E. ambigua* pre-

## Abstract

The name *Eucalyptus ambigua* DC. has been suggested as the correct name for a Tasmanian endemic eucalypt, the Smithton Peppermint (herein referred to as *E. nitida* Hook.f.), based on the non-glaucous character of the type specimen. However, the type of *E. ambigua* is inconsistent with other specimens of *E. nitida* housed at the Tasmanian Herbarium, as its fruit is outside the range of sizes observed on *E. nitida*. Its fruit size, non-glaucous character and provenance suggest the strong possibility that *E. ambigua* represents a hybrid or clinal form involving *E. tenuiramis* Miq. and *E. nitida*. Given the high level of uncertainty in determining its exact identity, *E. ambigua* should not be considered an older name for the Smithton Peppermint.

***Key words*:** taxonomy, fruit size, hybridisation in eucalypts

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**Figure 1.** G00131709, lectotype of *Eucalyptus ambigua* DC., sheet 2.
Image courtesy of Catalogue des herbiers de Genève (CHG). Conservatoire & Jardin botaniques de la Ville de Genève, 28-04-2014 <http://www.ville-ge.ch/musinfo/bd/cjb/chg>.

dates *E. nitida* by 18 years, he argued that the former is the correct name for this taxon. This name change has important consequences, as the Smithton Peppermint is one of Tasmania's most common endemic eucalypts. In light of Bean's (2009) paper, we examined the collections of the Tasmanian Herbarium (HO) and show why we believe Bean's conclusion to be incorrect and unjustified.

## Materials and methods

Photographs of the types of *Eucalyptus nitida* and *E. ambigua* were obtained from the Kew Herbarium (K) and the Herbarium of Prodrome de Candolle, housed in Geneva (G-DC), respectively. Ninety-six specimens each of *E. nitida* and *E. tenuiramis* in the Tasmanian Herbarium (HO) collections were chosen to represent the spread of their morphological and geographic ranges.

The diameter of three randomly chosen fruit per specimen was measured, yielding a total of 288 fruit for each species. Fruit diameter measurements were sorted into bins of 0.5 mm and the frequency of measurements in each bin was plotted as a histogram.

## Results

The type of *Eucalyptus ambigua* (G00131709) has three fruits, all approximately 9 mm in diameter (Fig. 1). By comparison the mean fruit diameter of *E. nitida* is 6.0 mm ($\sigma = 0.8$ mm), and that of *E. tenuiramis* is 8.6 mm ($\sigma = 1.2$ mm). Figure 2 provides a histogram of fruit diameter frequencies in both *E. nitida* and *E. tenuiramis*, illustrating the relatively small amount of overlap between the two species in the 6–8 mm range. The type of *E. ambigua* is outside the size range of *E. nitida*, but within the range of common fruit diameters of *E. tenuiramis*. However, the photographs of G00131709 show no evidence of glaucous bloom, which is a defining character of *E. tenuiramis*.

Specimens otherwise consistent with *E. tenuiramis*, but not or only slightly glaucous, can be found in the HO collection. For example HO119160 (Fig. 3), collected within the range of localities visited by Labillardière, shows only a hint of waxy bloom in the mature stems.

## Discussion

*Eucalyptus nitida* and *E. tenuiramis* are both endemic to Tasmania and comprehensive collections of both species are housed at the Tasmanian Herbarium (HO). We have examined all these specimens, and strongly disagree with Bean's conclusion. The fruit size of the lectotype of *E. ambigua* is outside the range measured in a representative sample of 96 HO specimens of *E. nitida*. Although Chippendale (1988, p. 192) gives the range of fruit diameters of *E. nitida* as 5–9 mm wide, specimens with fruit at the larger end of this range are rare, and only seven of 288 fruit measured for this study exceeded 8 mm in width. The possibility that fruit towards the larger end of the range are the result of intergrades with other species cannot be discounted. In addition to this, the lectotype of *E. nitida* (K000279983, held at Kew) has fruit that are approximately 4–5 mm in diameter (Fig. 4), compared to the approximately 9 mm-diameter fruit of the type of *E. ambigua*. Specimens of *E. nitida* housed in HO have an average diameter of 6 mm, again significantly smaller than those of the type of *E. ambigua*. The original description of *E. ambigua* (de Candolle 1828, p. 219) states: '*Affinis E. ligustrinae et amygdalinae. Fructus subglobosus duplo major*', thus describing the fruit of *E. ambigua* as twice the size of those of *E. ligustrina* DC. and *E. amygdalina*, the latter of which has a fruit of comparable size to *E. nitida*. Another common peppermint from the area of south-eastern Tasmania in which Labillardière collected is the Silver Peppermint, *E. tenuiramis*. The average diameter of fruits in specimens of *E. tenuiramis* housed in HO (8.6 mm) is closer to that of the type of *E. ambigua*. In addition, the leaves on the type of *E. ambigua* are broader and shorter than those commonly encountered in *E. nitida*, and more typical of the leaves of *E. tenuiramis*.

The non-glaucous nature of the type of *E. ambigua* is used by Bean (2009) to justify his conclusion that this specimen is the same as *E. nitida*. However, specimens otherwise closest to *E. tenuiramis*, but exhibiting little or no glaucous bloom, are found throughout the range of this species, including southern Bruny Island (where Labillardière collected), and these most likely represent instances of introgression with non-glaucous species. *Eucalyptus tenuiramis* and *E. nitida*, like many peppermints, are known to intergrade wherever their ranges overlap, such as in southern Tasmania (Duncan 1989). There is a high probability that non-glaucous specimens identified in the HO collection as *E. tenuiramis* are a result of introgression between *E. tenuiramis* and *E. nitida*. There remains a strong

possibility that G00131709 was collected from just such a clinal population between the two species, exhibiting characters from both parents.

In conclusion, the type of *E. ambigua* is not consistent with the range of morphological variation encountered in *E. nitida*. Its fruit size is within the range of *E. tenuiramis*, however the lack of any glaucous character strongly indicates a degree of introgression with another peppermint, most likely *E. nitida*. The type of *E. ambigua* was collected in an area of Tasmania where clinal forms between the two species are known to occur. Due to the taxonomic uncertainty regarding its type, and the possibility of its clinal origin, the name *E. ambigua* DC. should not be taken up. *Eucalyptus ambigua* is certainly not applicable to the Smithton Peppermint, which we reinstate as *E. nitida*. It may be prudent to formally reject the name *E. ambigua* so that its identity no longer needs to be considered and the name cannot be applied to any species of *Eucalyptus*.

## Taxonomy

***Eucalyptus ambigua*** DC., *Prodr.* [A. P. de Candolle] 3: 219 (1828)

***Type:*** **TASMANIA.** New Holland [SE Tasmania], J.J.H. Labillardière *s.n.*, *s.d.* [1792–1793] (lecto: G-DC [G00013170g] *fide* Bean (2009)).

Identity doubtful, most likely a clinal form between *Eucalyptus nitida* and *E. tenuiramis*.

***Eucalyptus amygdalina*** Labill., *Nov. Holl. Pl.* 2: 14 t.154 (1806)

***Type:*** **TASMANIA.** 'in capite Van-Diemen'.

*Eucalyptus salicifolia* Cav., *Icon. Pl.* 4(1): 24 (1797) (as '*salicifolius*'). Type not cited.

*Eucalyptus glandulosa* Desf., *Catalogus Plantarum Horti Regii Parisiensis*, ed. 3, 284, 408 (1829). *Type:* 'H. p. N. Holl. Temp'.

***Common name:*** Black Peppermint.

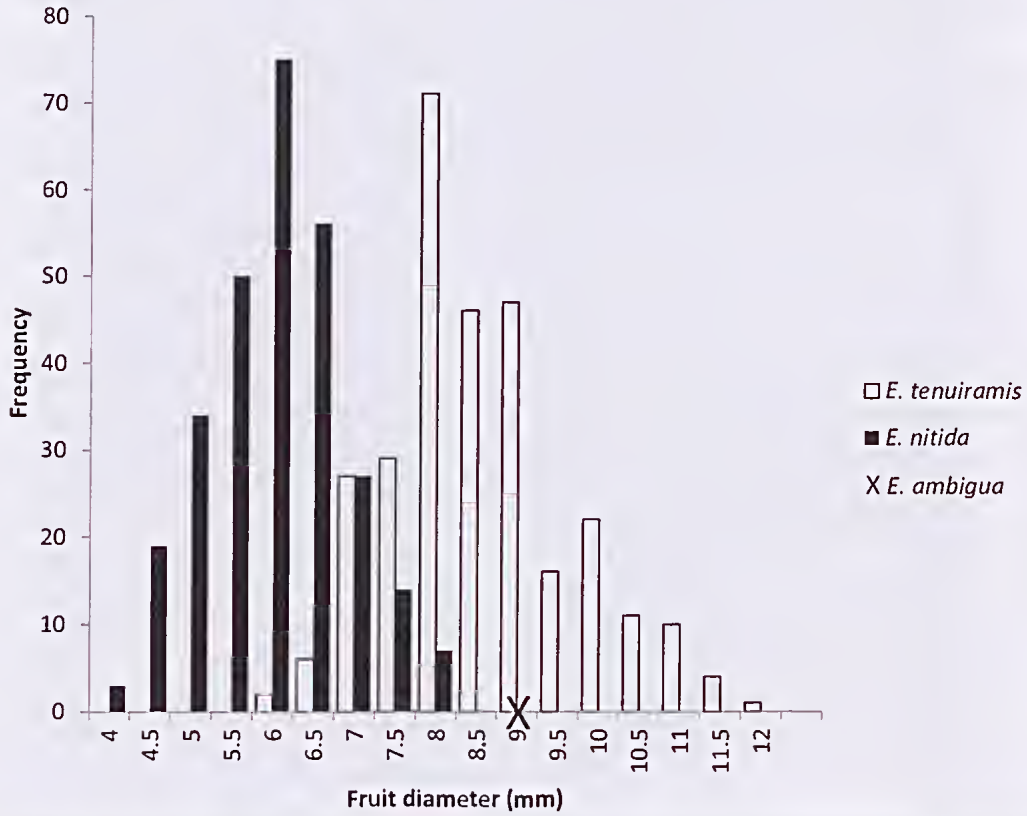


**Figure 2.** Histogram showing frequency of occurrence of fruit diameters for *Eucalyptus nitida* and *E. tenuiramis* (measured from three separate fruits in 96 specimens of each) along with the same measurement for the type of *E. ambigua*

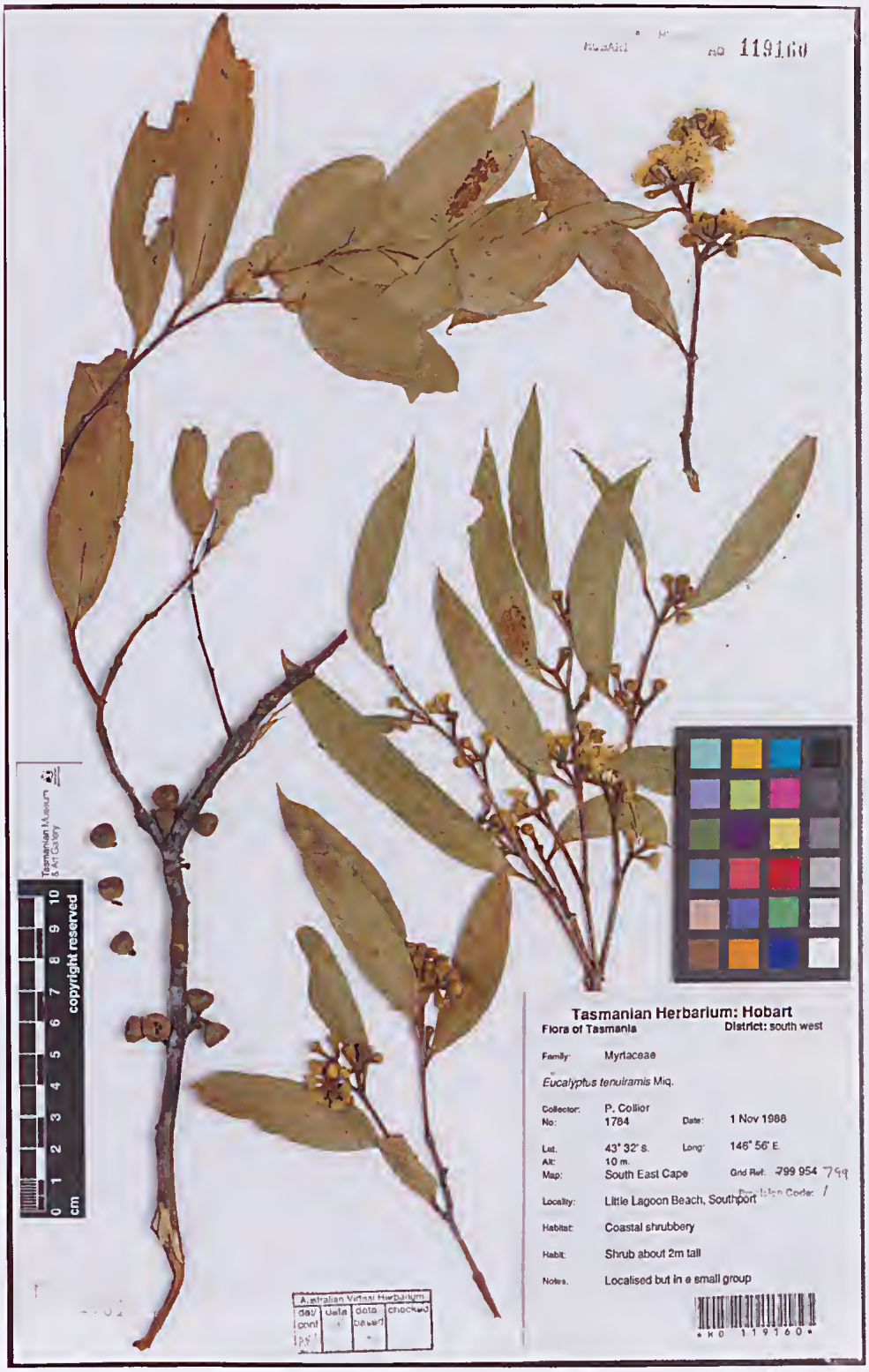


**Figure 3.** HO119160, *Eucalyptus tenuiramis* from the Southport Lagoon area, one of the possible locations where the type of *E. ambigua* was collected, showing almost no glaucousness

**Figure 4.** K000279983, lectotype of *Eucalyptus nitida*

***Eucalyptus nitida*** Hook.f., *Bot. Antarct. Voy. III. (Fl. Tasman.)* 1: 137, t. 29 (1856)

*Eucalyptus amygdalina* var. *nitida* (Hook.f.) Benth., *Fl. Austral.* 3: 203 (1867); *E. australiana* var. *nitida* (Hook.f.) Ewart, *Fl. Victoria* 833 (1931). *Type:* Tasmania. Circular Head, *R.C. Gunn 808*, 21 Jan 1837 (lecto: K [K000279983], *fide* Chippendale (1988)).

*Eucalyptus simmondsii* Maiden, *Crit. Rev. Eucalyptus* 6: 344 (1923). *Type:* Tasmania. Smithton, *J.H. Simmonds s.n.*, 27 May 1921 (syntypes: NSW [NSW337342, 337343]).

***Common name:*** Smithton Peppermint.

***Eucalyptus tenuiramis*** Miq., *Ned. Kruidk. Arch.* 4: 128 (1856)

***Type:* TASMANIA.** Van Diemensland [?near Southport (Chippendale 1988)], *C. Stuart 11, s.d.* [1842–1857] (Holo: U [U0004997]).

*Eucalyptus tasmanica* Blakely, *Key Eucalypts* 225 (1934) p.p. (description only, see Gray 1976).

***Common name:*** Silver Peppermint.

## Acknowledgements

The authors would like to thank Dr Gintaras Kantvilas (Tasmanian Herbarium), Dean Nicolle (Currency Creek Arboretum) and Professor Brad Potts (University of Tasmania) for discussions and feedback on this work.

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Muelleria

33: 75–83

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# Notes on *Potentilla* (Rosaceae) and related genera in Australia

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## Abstract

*Patentilla nanapetala* A.R.Bean, a new endemic Australian species, is described, illustrated, and its distributian mapped. The name *Argentina anserina* (L.) Rydb. (farmerly *Potentilla anserina* L.) is accepted. *Potentilla crantzii* (Crantz) Beck ex Fritsch is remaved from the Australian flora; and the genus *Fragaria* L. reinstated for Australia. A key to the Australian *Patentilla* L., *Fragaria* and *Argentina* Hill is presented.

***Key words:*** *Argentina*, *Fragaria*, new species, Australian flara, identificatian

## Introduction

*Potentilla* L. is a large genus of about 490 species (Soják 2009), with its greatest species diversity in the temperate and boreal regions of the northern hemisphere. Molecular phylogenetic studies over the last decade or so have done much to clarify the relationships within *Potentilla*, allowing a more objective way of determining the status of the numerous satellite genera. *Argentina* Hill is one such genus of long standing, which was reinstated by Soják (2010), based on the convincing evidence of Dobeš and Paule (2010).

Australia has six species of *Potentilla* and a single *Argentina* species, and recent state floras and censuses (Harden & Rodd 1990; Barker et al. 2005; Walsh & Stajsic 2008) assign them all as alien to Australia.

In this paper, a *Potentilla* sp. from arid parts of eastern central Australia is shown to be distinct from any other named species, and is endemic (and therefore indigenous) to Australia. It is formally described here as *Potentilla nanopetala* A.R.Bean, and its distribution is mapped and illustrations are provided. *Potentilla anserina* L. is transferred to the recently reinstated genus *Argentina*, as *Argentina anserina* (L.) Rydb., and its origin status and taxonomic status are discussed. The Australian record of *Potentilla crantzii* (Crantz) Beck ex Fritsch is found to be erroneous, and that name is removed from the Australian flora. The genus *Fragaria* L. is reinstated on the basis of recent molecular studies.

A dichotomous key to all Australian native and naturalised taxa of *Potentilla*, *Fragaria* and *Argentina* is presented.

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## Materials and methods

This study is based on an examination of herbarium specimens from AD, BRI, CANB, MEL and NSW, including more than 60 specimens of *Potentilla supina* L., 50 specimens of *P. anserina* and one specimen of *P. heynii* Roth. In addition, several high-quality images of herbarium specimens of *P. heynii* have been examined, originating from the Museum National d' Histoire Naturelle (P). Images of type specimens of *P. supina* and *P. anserina* have been viewed. Measurements of petals, stamens and carpels are based on material preserved in spirit, or reconstituted with boiling water; all other measurements were made from dried herbarium specimens. *Potentilla nanopetala* has been examined in the field by the author.

## Taxonomy

***Potentilla nanopetala*** A.R.Bean, **sp. nov.**

***Type:*** **SOUTH AUSTRALIA.** Burlieburlie Waterhole off the Strzelecki Track, S of Innamincka, 27° 48'S 140° 43'E, 23 October 2007, *T.S. Te 205, D.J. Duval, P.J. Lang & M.J. Thorpe* (holo: AD 213898; iso: K, *n.v.*).

With affinity to *P. heynii*, but differing by the terminal leaflet and lateral leaflets not deeply incised, the stem indumentum with two classes of hairs, the often shorter fruiting pedicels, and the consistently and conspicuously ribbed achenes.

[*P. supina auct. non* L.; Jacobs & Pickard (1981), Harden & Rodd (1990), Barker et al. (2005), APC (2014)]

Decumbent, suberect or erect annual herb to 20 cm high and 30 cm across, runners absent. Leaf rosettes absent from fertile plants. *Stems* and petioles terete, with two distinct indumentum types; pilose hairs, moderately dense to dense, spreading, seemingly unicellular, cylindrical in transverse section, 0.5–1.4 mm long; and curved to flexuose hairs, uniseriate, 2–5-celled, segments flattened, each segment at right angles to the adjacent one, 0.15–0.4 mm long. *Leaves* all ternate (some plants), or mostly ternate, with some of the lower leaves pinnate, with 5 leaflets (some plants); stipules adnate to base of petiole, oblong to elliptical, 2.0–3.5 mm long, 0.8–1.0 mm wide, green, pilose throughout, margins entire, apex obtuse. Petioles 3.5–18 mm long, the longer ones towards the base of the plant; lamina 5.0–14.0 mm long; terminal leaflet broadly obovate, 4.5–9.0 mm long, shortly petiolulate, with 7–9 obtuse lobes, incised about halfway to midrib; lateral leaflets opposite or slightly disjunct, obovate, 2.5–6.0 mm long, sessile, with 3–6 obtuse lobes incised about halfway to midrib; petioles and leaves with numerous unicellular pilose hairs on both surfaces, multicellular hairs absent. *Flowers* axillary, solitary, 3.2–5.0 mm diameter, 5-merous; pedicels 1.3–2.1 mm long. *Epicalyx* segments elliptical, 1.3–2.5 mm long, 0.5–0.9 mm wide, slightly shorter than sepals, with numerous antrorse unicellular hairs on both surfaces, margins entire, apex obtuse; *sepals* triangular, 1.6–3.0 mm long, 1.3–1.5 mm wide at base, with numerous antrorse unicellular hairs on outer surface, apex acute. *Petals* elliptical to spathulate, 1.0–1.2 mm long, 0.5–0.6 mm wide, much shorter than sepals, glabrous, yellow, apex obtuse. *Stamens* 14–16 in two whorls; anthers basifixed, 2-locular, 0.15–0.2 mm long; shorter filaments 0.25–0.4 mm long, longer filaments 0.6–0.7 mm long; staminal filaments surrounded by erect, dense, transparent, unicellular hairs, c. 0.6 mm long. *Carpels* glabrous, c. 50 per flower; torus subglobose, glabrous or with scattered patent hairs. *Style* slender, subterminal, sparsely glandular, 0.3–0.5 mm long, width uniform for much of its length, but tapering near the apex. *Fruit* enclosed by epicalyx and sepals; fruiting pedicels erect, 1.8–7 mm long; achenes 0.6–0.7 mm long, 0.45–0.5 mm diameter, ovoid, pale brown to black, glabrous, with a few conspicuous longitudinal ribs. (Fig. 1)

***Specimens examined:*** **NEW SOUTH WALES.** Billabong of Darling River, 10 km SW of Wilcannia, 31° 38'S 143° 18'E, 16.v.1979, *K. Paijmans 2766* (CANB); Billabong of Darling River, 10 km SW of Wilcannia, 31° 38'S 143° 18'E, 8.vi.1979, *K. Paijmans 2809* (CANB, NSW); Narran Lakes Nature Reserve, c. 71 km by road ENE of Brewarrina, 29° 41'S 147° 27'E, 15.ix.2004, *A.R. Bean 22942* (BRI, NSW); On edge of Cavendilla Creek, WSW of picnic area, Kinchega N.P., 32° 24'S 142° 14'E, 20.iii.1997, *A.D. Auld 410* (NSW). **SOUTH AUSTRALIA.** Near King's grave (S of the Cooper), 27° 45'S 140° 44'E, 8.vii.1997, *R. Bates 47341* (AD); Near King's grave (S of the Cooper), 27° 45'S 140° 44'E, 8.vii.1997, *R. Bates 47347* (AD).

***Distribution and habitat:*** *Potentilla nanopetala* is known from near Innamincka in the far north-east of South Australia, and in north-western New South Wales (Fig. 2). It is not recorded from Queensland, but as the South Australian records are just 30 km from the border, it is highly likely that it will be found there. At most sites it is recorded from edges of billabongs, with associated

**Figure 1.** *Potentilla nanopetala*. **A.** whole plant (×0.6); **B.** stem indumentum (×32); **C.** a lower leaf and stipule (×6); **D.** oblique view of flower (×12); **E.** petal (×24); **F.** calyx, epicalyx and stamens (×8); **G.** mature achene, with attached style (×32). (**A–C, E–G** from *Bean 22942*, BRI; **D.** from *Te 205 et al.*, AD).

indigenous herbaceous genera including *Calotis* R.Br., *Glinus* L., *Centipeda* Lour., *Alternanthera* Forssk. and *Heliotropium* L. At Narran Lake Nature Reserve (New South Wales), it grows in the 'Chenopod Low Open shrubland & ephemeral herbfield' (McGann et al. 2001) on the margins of the lake.

***Phenology:*** Flowers and fruits are recorded for March, May, June, July and September, but it probably would flower and fruit at any time of year when there is sufficient soil moisture.

***Conservation status:*** Data deficient (IUCN 2012). This is a small plant, very ephemeral in nature, with inconspicuous flowers, and growing in places not often visited by botanists. While only a few collections are known, it is likely that the species is present in alluvial habitats throughout its known geographical range.

***Etymology:*** From the Greek *nanos* (a dwarf), and *petalon* (petal), in reference to the very small petals in this species.

***Notes:*** The first specimens of *Potentilla nanopetala*, collected in 1979, were identified as the Asian and European species *P. supina* in Jacobs and Pickard (1981), and that name has been used in Australian state floras and censuses since then.

*Potentilla nanopetala* keys readily to *P. supina* in *Flora Europaea* (Ball et al. 1968) if the 'Leaves pinnate' lead is followed, because it has yellow petals, solitary flowers in the leaf axils, and petals shorter than sepals. However, if the 'Leaves ternate or digitate' lead is followed, *P. nanopetala* keys with difficulty to *P. norvegica* L. In the *Flora of Turkey* (Pesman 1972), *P. nanopetala* will key to *P. supina*, except that the stated '5–11 leaflets' does not fit it. It does not key to *P. supina* in Soják (2012), because it has fewer leaflets than *P. supina; P. supina* appears there only in 'Key E', and that key is diagnosed by 'at least some leaves with three or more pairs of leaflets'.

*Potentilla nanopetala* differs from *P. supina* by the 3 (rarely 5) leaflets (5–11 leaflets for *P. supina*); the pedicels 1.3–2.1 mm long in flowering material (3–12 mm long

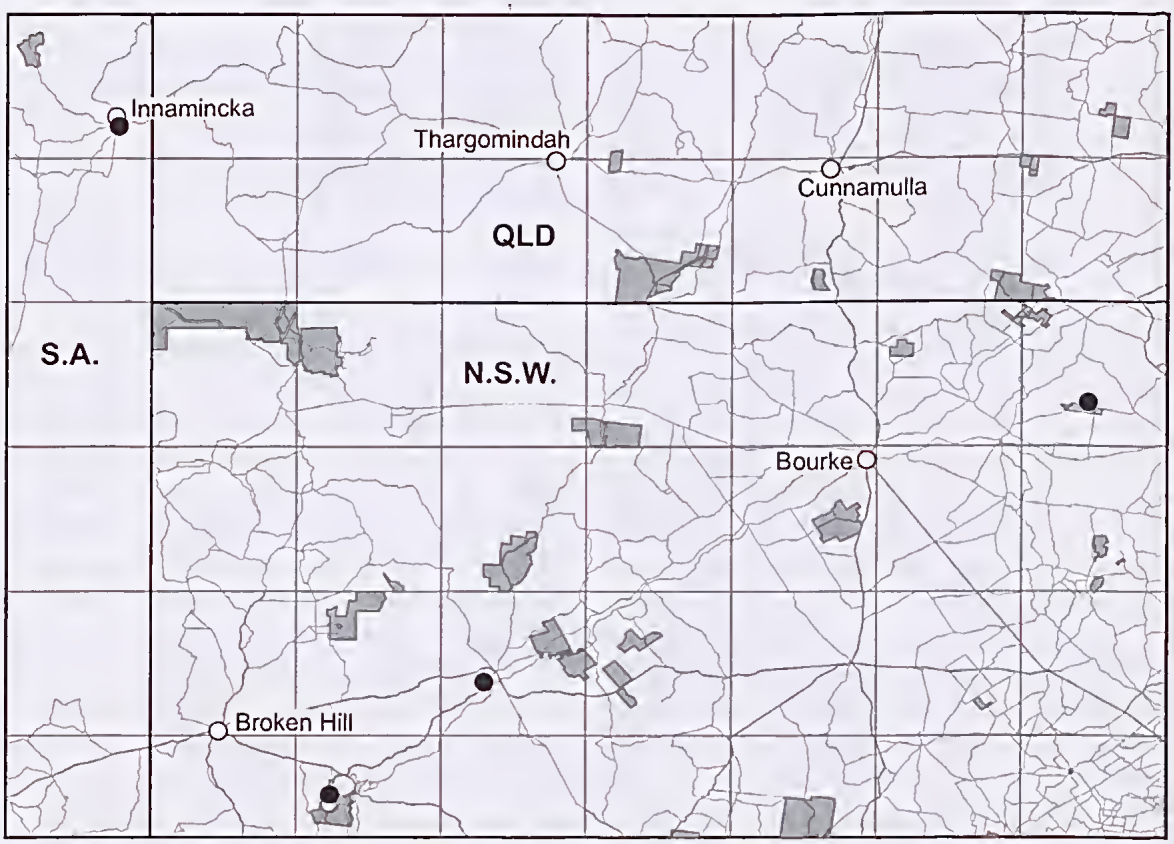


**Figure 2.** Distribution of *Potentilla nanopetala* (closed circles)

for *P. supina*); the pedicels 1.8–7 mm long in fruiting material (5–18 mm long for *P. supina*); the elliptical to spathulate petals 1.0–1.2 mm long with obtuse apex (broadly obovate petals 2–3 mm long with emarginate apex for *P. supina*); and the epicalyx segments shorter than sepals (equal to or longer than sepals for *P. supina*).

*Potentilla heynii* Roth is a species related to both *P. supina* and *P. nanopetala*. It had often been included with *P. supina*, until it was resurrected by Soják (1988). Its synonyms include *P. amurensis* Maxim. and *P. parvipetala* B.C.Ding & S.Y.Wang (Soják 2009). I believe that *P. obovata* Bertol. is a synonym of *P. supina*, as given in The Plant List (2013), and not a synonym of *P. heynii*, as determined by Soják on the syntype at K (Kew Catalogue 2015). *Potentilla heynii* ranges from northern India to Korea (Soják 1988), and closely resembles *P. nanopetala* in that its petals are the same size and shape, and the flowers are axillary.

*Potentilla heynii* and *P. nanopetala* can be distinguished by the morphology of the leaves, the stem indumentum, the pedicel length, and achene morphology. Some plants of *P. heynii* can have ternate leaves throughout, but then the terminal leaflet is trisect, and the lateral leaflets are bisected almost to the midrib (Soják 1988; Soják 2004; Soják 2007). The lowermost stem leaves of *P. heynii* are either palmate with five leaflets from which the middle one is trisect, or pinnate with two or three pairs of leaflets (Soják 1988). In *P. nanopetala*, the leaves are all ternate on some plants, while other plants have leaves predominantly ternate, but some pinnate leaves (with 5 leaflets) are present on the lower part of the plant; the terminal leaflet usually has 7–9 more or less equal lobes that are divided about halfway to the midrib (rarely more). Similarly, the lateral leaflets are not deeply bisected, but have 3–6 shallow obtuse lobes. The lower stem leaves of *P. nanopetala* are either ternate with the terminal leaflet shallowly lobed, or pinnate with 2 pairs of leaflets, where the lateral leaflets are not bisected.

*Potentilla nanopetala* has two distinct indumentum types on the stems and petioles: a) pilose, unicellular, cylindrical hairs, and b) shorter 2–5-celled hairs with flattened segments. *Potentilla heynii* has only pilose, unicellular, cylindrical hairs; it completely lacks the 2–5-celled hairs with flattened segments.

Some of the achenes of *P. heynii* are 0.6–0.7 mm long, smooth or with minute ribs, while other achenes are 0.7–0.9 mm long with strong ribs (Soják 1988). In *P. nanopetala*, all achenes are 0.6–0.7 mm long, and all have conspicuous ribs.

A specimen of *P. heynii* has been examined by the author (AD98148115), confirming its markedly different leaf morphology and indumentum as compared to *P. nanopetala* (outlined above). The fruiting pedicels of this specimen are 7.5–9.5 mm long (1.8–7 mm long for *P. nanopetala*); the achenes are 0.6–0.65 mm long, and smooth (conspicuously ribbed for *P. nanopetala*). Online specimen images of *P. heynii* (specimens from P), determined by *Potentilla* specialist Jiri Soják, also confirm the differences in the leaf morphology and indumentum already alluded to. The fruiting pedicels on these specimens are 5–10 mm long.

*Potentilla heynii* is treated in the *Flora of China* (Chaoluan et al. 2003) under the name *P. supina* var. *ternata* Petermann, which according to Soják (2007), is a misapplied name. Chaoluan et al. (2003) stated that *P. supina* var. *ternata* has the margin of the central leaflet '2 or 3-parted'. This is in accordance with Soják (1988, 2004, 2007), but differs strongly from *P. nanopetala* where the leaflet margin bears numerous lobes that are not deeply incised.

Fedorov et al. (1971) described *Potentilla amurensis* Maxim., which is a synonym of *P. heynii* (Soják 2009). They described the terminal leaflet as 'deeply 3-partite', and the lateral leaflets '2-partite with an oblique base and spreading or declinate lobes (leaves often appearing quinate)'.

*Potentilla nanopetala* will key to *P. norvegica* in *Flora Europaea* (Ball et al. 1968). *Potentilla norvegica* differs from *P. nanopetala* by the leaflets 10–70 mm long (2.5–9 mm long for *P. nanopetala*), sepals c. 10 mm long in fruit (1.6–3.0 mm long for *P. nanopetala*), and petals 4–5 mm long (1.0–1.2 mm long for *P. nanopetala*).

Another similar species is *P. centigrana* Maxim., which keys out next to *P. supina* in Chaoluan et al. (2003). *Potentilla centigrana* differs from *P. nanopetala* by its serrated stipules; pedicels glabrous or subglabrous, 5–20 mm long; styles with a thickened base; and the smooth achenes c. 1 mm diameter.

The recognition of *P. nanopetala*, an endemic southern hemisphere species, previously misidentified as a northern hemisphere species (*P. supina*), is not without parallel. Castagnaro et al. (1998) described

*P. tucumanensis* A.Castagnaro & M.Arias, a species endemic to northern Argentina. It had, since 1900, been identified as *P. norvegica*, a European species.

*Potentilla nanopetala* is here regarded as an indigenous and endemic Australian species. A label attached to one of the herbarium specimens of *P. nanopetala* (*Bates 47347*) says 'The ephemeral Aust[ralian] desert plants are probably an endemic form, R. Bates, Dec 98'. It meets a majority of the ecological criteria of Bean (2007); it is not persistently invasive; geographical discontinuities are related to soil type and habitat, rather than human settlement patterns; it consistently occurs in intact unmodified habitat – no human disturbance is noted on any of the specimen labels, nor are any weeds listed. At the site visited by the present author, the habitat was absolutely weed free and there was no evident human disturbance.

***Potentilla crantzii*** (Crantz) Beck ex Fritsch

This species is recorded as being naturalised in South Australia (APC 2014). This record is based on a single specimen at AD (*Bates 27409*). However, my examination of this specimen revealed that it was misidentified. The specimen is in fact *Potentilla argentea* L. Therefore, the name *P. crantzii* can be removed from Australian flora lists.

***Argentina*** Hill, *Brit. Herb. (Hill)* 6 (1756)

***Type:*** *A. vulgaris* Hill

*Potentilla* sect. *Pentaphylloides* Tausch, *Hort. Canal.* 1: sub *P. ornithopoda* (1823). *Type: P. fruticosa* L.

*Argentina* was described by Hill in 1756, for the species that Linnaeus described as *Potentilla anserina*. Rydberg (1908) accepted the genus as distinct and described several species of *Argentina* and transferred a few species from *Potentilla*, but for the last century the genus has been included in synonymy with *Potentilla*. A molecular phylogenetic study by Eriksson et al. (2003) showed that *P. anserina* and a few other species formed a separate clade from all other *Potentilla* species, but was based on limited taxon sampling. The more comprehensive sampling of Dobeš and Paule (2010) has reinforced the distinctiveness of the *Argentina*-clade, and they recommended the acceptance of *Argentina* as a distinct genus. Soják (2010) made the required combinations.

*Argentina* comprises 64 species, mainly in the Himalayan region of Asia and in alpine New Guinea. There is one species in Australia, and one species in New Zealand.

***Argentina anserina*** (L.) Rydb., *Mem. Dept. Bot. Columbia Coll.* 2: 159 (1898)

*Potentilla anserina* L., *Sp. Pl.* 1: 495 (1753).

***Type:*** Lectotype: Herb. Clifford: 193, *Potentilla* 1 (BM-000628646), *fide* Rousi in *Ann. Bot. Fenn.* 2 : 101 (1965).

***Distribution and habitat:*** In Australia, *Argentina anserina* occurs in Tasmania, southern Victoria, southern New South Wales, and south-eastern South Australia. According to Barker et al. (2005), *Potentilla anserina* is extinct in the 'Southern Lofty' region of South Australia, judging by available herbarium specimens, with the most recent collections being in the 1880s. It has not been collected in New South Wales since 1959 (AVH 2014). It is apparently stable in Victoria and Tasmania, as there are some recent collections from those states. There is a single record on Australia's Virtual Herbarium (AVH 2014) from the far south-west of Western Australia, but that record is erroneous, the result of a misidentification. The specimen involved (*W.R. Barker 2317*) is in fact *Hibbertia grossulariifolia* (Salisb.) Salisb.

***Notes:*** Soják (1994) published a key to *Potentilla* sect. *Pentaphylloides* Tausch, as a precursor to an intended revision of the group. However, that revision did not occur. The key included a few *nomina nuda* for taxa he intended to describe or combinations that he intended to make, including *P. anserina* subsp. *australiensis* Soják nom. inval., for the form of *Potentilla anserina* (=*Argentina anserina*) that occurs in Australia. The differences cited by Soják for subsp. *australiensis* (erect hairs on the petioles, and carpels usually hairy) are not consistent and Soják later stated (in litt., MEL596484) that he did not proceed with the naming of the subspecies after having seen additional Australian material.

*Argentina anserina* (as *Potentilla anserina*) has been regarded as an alien species in Australia (Jeanes & Jobson 1996; Barker et al. 2005; Walsh & Stajsic 2008; Baker & de Salas 2012). However, it was collected by Robert Brown in 1804 from northern Tasmania (Bentham 1864), just months after the arrival there of European settlers, and its apparent diminution in the wild (based on the lack of recent herbarium collections

**Key to the Australian native and naturalised taxa of *Argentina*, *Fragaria* and *Potentilla* (based on Australian material; naturalised taxa indicated by an asterisk)**

1 Leaves with 9–20 leaflets ..... ***Argentina anserina***
1: Leaves with 3–7 leaflets ..... 2

2 All leaves with 3 leaflets, or some leaves pinnate with 5 leaflets ..... 3
2: All leaves digitate, and some leaves with 5–7 leaflets ..... 6

3 Leaflets 3(–5); lamina of terminal leaflet 4.5–9 mm long; ripe achenes pale brown to black; decumbent to erect herb without runners ..... ***Potentilla nanopetala***
3: Leaflets 3; lamina of terminal leaflet 10–65 mm long; ripe achenes red; trailing herbs with long runners ..... 4

4 Epicalyx segments 3–5-lobed; petals yellow; hairs on lower leaf surface confined to veins ..... ****Potentilla indica***
4: Epicalyx segments entire; petals white; hairs distributed all over lower leaf surface ..... 5

5 Achenes 1.2–1.3 mm long; petals 5–8 mm long; inflorescence branched only near apex ..... ****Fragaria vesca***
5: Achenes 1.3–1.5 mm long; petals 8–10 mm long; inflorescence branched from about half-way ..... ****Fragaria* × *ananassa***

6 Leaflets silvery on the underside ..... ****Potentilla argentea***
6: Leaflets green on the underside ..... 7

7 Plants erect; inflorescences terminal, cymose; leaflets 5–7 ..... ****Potentilla recta***
7: Plants decumbent; inflorescence axillary; leaflets 3–5 ..... 8

8 Flowers mostly 4-merous, sometimes 5-merous; carpels 20–50 ..... ****Potentilla anglica***
8: Flowers all 5-merous; carpels 60–120 ..... ****Potentilla reptans***

from South Australia and New South Wales) suggests an indigenous plant species being outcompeted by weeds. The existence of the very similar *Argentina anserinoides* (Raoul) Holub (syn. *Potentilla anserinoides* Raoul), an endemic of New Zealand, suggests that progenitors arrived in Australasia without the aid of man. As I have no field knowledge of *A. anserina* in Australia, I am unable to assess most of the ecological criteria of Bean (2007). The phytogeographical criteria present somewhat of a contradiction; on the one hand the presence of a closely related indigenous species in New Zealand (*A. anserinoides*) suggests an indigenous status for *A. anserina* in Australia, but the major disjunction of the nearest occurrence of *A. anserina* suggests an alien status. While the origin status in Australia is uncertain, I recommend that it be treated as indigenous until such time as molecular markers indicate otherwise.

Although on morphological grounds, I am unable to consistently distinguish the Australian taxon from *Argentina anserina* s. str. from the Northern Hemisphere, its geographic isolation from Northern Hemisphere populations questions whether the Australian taxon may be a separate genetic lineage worthy of taxonomic recognition. *Argentina anserina* has already been shown to be highly variable in chromosome number (Rousi 1965). For these reasons I do not advocate the usage of 'subsp. *anserina*' for Australia. Until a molecular study of the whole species is carried out, the taxonomic status of the Australian taxon will remain unresolved.

### *Fragaria* L., *Sp. Pl.* 494 (1753)

***Type:*** *F. vesca* L., fide Rydberg, *N. Amer. Fl.* 22: 356 (1908).

Mabberley (2002) advocated the reduction of *Fragaria* into *Potentilla*, a course which has been followed by Australian herbaria (APC 2014). His opinion was based partly on the initial study of Eriksson et al. (1998), which used a small data set, and produced some clades that were only weakly supported and tentative. Eriksson et al. (2003) expanded both the number of taxa and the number of gene regions examined. The resulting classification placed *Fragaria* and its allies in a separate well-supported clade (= Rosaceae subtribe *Fragariinae* Torr. & A.Gray), distinct from *Potentilla* s. str. The later studies of Potter et al. (2007), Lundberg et al. (2009), and Dobeš and Paule (2010) have all reinforced this finding.

*Duchesnea* Sm., on the other hand, is deeply nested within *Potentilla* s. str. (Eriksson et al. 2003).

All of these recent systematic studies have shown that *Fragaria* cannot be subsumed into *Potentilla* without expanding the boundaries of the latter genus to an excessive degree. To maintain monophyly, a merger between *Fragaria* and *Potentilla* would necessitate the sinking of all genera in the subtribe *Fragariinae*, including several other well-known and speciose genera, e.g. *Alchemilla* L., *Aphanes* L., *Sibbaldia* L. and *Drymocallis* Fourr. ex Rydb. This is an option that none of the above authors support. Therefore it is recommended here that *Potentilla* × *ananassa* (Weston) Mabb. and *P. vesca*, naturalised in Australia, be reinstated to *Fragaria*, as outlined below.

***Fragaria* × *ananassa*** (Weston) Duchesne ex Rozier, *Cours Compl. Agric.* 5: 52 (1785)

*Fragaria chiloensis* var. *ananassa* Weston, *Bot. Univ.* 2: 329 (1771); *Potentilla* × *ananassa* (Weston) Mabb., *Telopea* 9: 796 (2002), syn. nov.

***Fragaria vesca*** L., *Sp. Pl.* 1: 494 (1753)

*Potentilla vesca* (L.) Scop., *Fl. Carniol.* ed. 2, 1: 363 (1771).

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# Nomenclature, variation and hybridisation in Rough Blown-grass (Poaceae: *Lachnagrostis*)


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## Introduction

Variation in Rough Blown-grass (also known as Ruddy, Even or Meagre Blown-grass) has been previously examined by Brown (2006) with the result that *Lachnagrostis aequata* (Nees) S.W.L.Jacobs (syn. *Agrostis aequata* Nees) and *L. scabra* 'sensu Steud.' (syn. *Agrostis scabra* R.Br. non Willd.) were considered to be the same taxon. In addition, it was found that the name *L. aequata* had been misapplied to a Tasmanian montane taxon, which was subsequently described as *L. morrisii* A.J.Br.

Recent doubt expressed in Tropicos (2014) and APC (2014) concerning the status of *Vilfa scabra* P.Beauv. as a new name or a new combination for *A. scabra* Willd. or *A. scabra* R.Br. respectively, has initiated a closer examination of the name *L. scabra* Nees ex Steud.

The status of *L. scabra* subsp. *curviseta* A.J.Br. also required review in light of the discovery of probable hybrids between Rough Blown-grass and Common Blown-grass (*L. filiformis* (G.Forst.) Trin.), as both the subspecies and the hybrids are largely distinguished by their unusually long awns. In addition, recent collections of new populations of a dwarf form of Rough Blown-grass from Flinders Island, and its closer examination through PhD research by Brown (2013) has suggested its formal recognition.


## Abstract

The name *Lachnagrostis scabra* 'sensu Steud.' for Rough Blown-grass is found to be a misapplication of *Lachnagrostis scabra* Nees ex Steud. (currently known as *Agrostis pilosula* Trin.): an Asiatic taxon not found in Australia. The correct name for Rough Blown-grass is *Lachnagrostis rudis* (Roem. & Schult.) Trin. A dwarf form of the species from Flinders Island is described as *L. rudis* subsp. *nana* A.J.Br., based on morphological and cytological evidence. However, considerable variation of awn length within mainland populations has resulted in *L. scabra* subsp. *curviseta* A.J.Br. being subsumed by *L. rudis* subsp. *rudis*. Plants probably resulting from hybridisation between *L. rudis* and *L. filiformis* (G.Forst.) Trin. along the Crawford River near Dartmoor, Victoria are described as *L.* ×*ripulae* A.J.Br.



***Key words:*** hybrid, ploidy, taxonomy, Royle, Moleside Creek, Camerons Inlet



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## Materials and methods

The nomenclatural history for *Lochnogrostis scobro* was examined in detail, in reference to the original published descriptions of types. Additional collections of Rough Blown-grass since Brown (2006) from Victoria, Tasmania and South Australia were examined morphologically.

Seed from Moleside Creek in south-west Victoria and from Camerons Inlet on Flinders Island, Tasmania, was germinated and grown in pinebark potting mix into mature flowering plants (four plants per accession) in the nursery of the Royal Botanic Gardens Melbourne during 2010 and 2011. Measurements of plant height, culm length, leaf width and number and size of inflorescences were made and compared to at least four field plant collections of each of the same populations. Inflorescence measurements were made on 14–16 panicles across the plants of each population.

Prior to flowering, mature leaves were sampled from both nursery accessions, sealed in plastic bags and refrigerated until undergoing flow-cytometry analysis to estimate whole genome content (2C-value). The accession from Moleside Creek was also subjected to direct chromosome counting via a conventional root-tip thumb-squash method. The methodology for both flow cytometry and chromosome counts were described in the PhD thesis (Brown 2013).

## Results and discussion

### Nomenclatural examination

Palisot de Beauvois (1812) transferred more than half (approx. 62%) of the then current *Agrostis* L. names to *Vilfo* Adans. In the index to his work, he listed both the American *A. scabra* Willd. and the Australian *A. scabra* R.Br. as synonymous with his *V. scabra* P.Beauv., but also expressed doubt of such, inasmuch as question marks follow each name. Whether these question marks can be interpreted as Palisot de Beauvois's lack of knowledge regarding possible synonymy of *A. scobro* Willd. and *A. scobra* R.Br. or he was unsure as to which of the two taxa should be referred to *V. scabro* P.Beauv. is unknown. The confusing treatment of *A. scobro* R.Br., *A. scobro* Willd. and *Deyeuxia scobra* (R.Br.) Benth. by Bentham (1878) is described in Brown (2006) and likely illustrates that 19th-century taxonomists were unsure as to whether they were dealing with one, two, or more taxa.

Apart from the confusion related to *A. scobro*, Palisot de Beauvois (1812), in the same index, also questioned another 60-odd *Agrostis* names (approx. 47% of all listed names), including the Australian *A. oemulo* R.Br., *A. plebeia* R.Br., *A. retrofrocta* Willd. and *A. debilis* Poir. (the last two regarded as synonymous with *A. ovenacea* Gmel. by Vickery (1941)), seemingly because his direct knowledge of these New Holland taxa was limited. This large number of question marks causes one to wonder if, instead of being references to nomenclatural uncertainty, they may refer instead to types he had not viewed. Closer examination of the questioned names transferred to *Vilfo* (approx. 50), shows half to relate to non-European collections. Although Palisot de Beauvois made personal collections in West Africa, Haiti and the USA during the 1790s, most of these collections were destroyed by fire or shipwreck (Merrill 1936). Although the remainder of the 'uncertain' names he transferred to *Vilfa* were related to European taxa, almost all appear to be of single collections only, lack designated types or have uncertain authorship.

In addition to question marks related to *Agrostis* names, Palisot de Beauvois (1812) questioned 14 of his *Agrostis* to *Vilfo* transfers, including the cosmopolitan *A. littoralis* Lam. (syn. *Sporobolus virginicus* (L.) Kunth), and the Australasian *A. cylindrica* R.Br. (syn. *Deyeuxia quadriseto* (Labill.) Benth.), *A. lobata* R.Br. (syn. *Deyeuxio quodriseto* (Labill.) Benth.), *A. mogellanica* Lam., *A. rara* R.Br. (syn. *Dichelachne rara* (R.Br.) Vickery), *A. retrofracta* Willd. and *A. sciureo* R.Br. (syn. *Dichelachne microntha* (Cav.) Domin). In almost all of these cases, this questioning has been vindicated by later, and more informed, treatments of these species. However, apart from Palisot de Beauvois's questioning of his new *Vilfa* combinations, 23 of his non-questioned *Vilfo* combinations are now assigned to *Cynodon* Rich., *Deyeuxia* Clarion ex P.Beauv., *Digitoria* Haller, *Eriochloo* Kunth in Humb., *Gostridium* P.Beauv., *Muhlenbergia* Schreb., *Polypogon* Desf., *Sporobolus* R.Br. or *Stipa* L.

In Australia, Vickery (1941) was of the opinion that *A. scobro* R.Br. was the basionym for *V. scabra* '(R.Br.) P.Beauv.', while in North America, Niles and Chase (1925) and Hitchcock (1951) regarded *A. scobro* Willd. as the basionym for *V. scobra* '(Willd.) P.Beauv.' Because *A. scobro* R.Br. (1810) is a later homonym of *A. scabra* Willd. (1797) and therefore illegitimate, Vickery utilised

*A. rudis* Roem. & Schult. as the next legitimately published name based on the Robert Brown collection that was also the type of *A. scabra* R.Br. Jacobs (2002) followed Vickery's (1941) basionym interpretation, but cited *V. scabro* 'P.Beauv.' as a nomen novum for *A. scabra* R.Br., and consequently, *V. scabra* as the basionym for *Lachnagrostis scabra* '(P.Beauv.) Nees ex Steud.'. Likewise, Jacobs (2002) added *Deyeuxia scabro* '(P.Beauv.) Kunth' in synonymy, which, under the interpretation of *V. scabra* 'P.Beauv.' nom. nov. for *A. scobro* R.Br., would be a correct citation, even though Kunth (1829) made no reference to Beauvois but transferred *A. scabro* R.Br. to *D. scabra* '(R. Br.) Kunth'.

Despite Palisot de Beauvois questions in relation to the name *V. scobra* P.Beauv., it is here treated, not as a nom. nov. but as a comb. nov. for *A. scabra* Willd. (rather than for *A. scabro* R.Br.) on the basis that the former is the earlier and therefore legitimate name. Article 36.1 of the *International Code of Nomenclature for algae, fungi, and plants* (McNeill et al. 2012) indicates that a name is not invalidly published even if there is a question mark or other indication of taxonomic doubt, if that name is accepted by its author.

Steudel (1840, 1841) introduced the name *Lachnogrostis scabra* Nees ex Steud., not as a new combination for any prior name but for an unpublished Nees name, found on a collection at the Royle Herbarium. In the same publication, he replaced the name with *Calamogrostis neesii* Steud. 'Ind. or.' (Part 1, p. 250), presumably as the species name '*scobro*' was already taken by the Alaskan/Canadian taxon, *C. scabro* Presl, (syn. *Deyeuxia preslii* Kunth) (Part 1, p. 251). However, in a mistaken twist, he also referred *L. scabra* Nees to *C. scabra* instead of to *C. neesii* (Part 2, p. 2). Steudel (1854) does not repeat this mistake.

Trinius (1841) refers to *L. scobro* 'N. ab. Es. Ind. orient. reg. mont. super. (Royle)' as a synonym of *Agrostis pilosula* Trin. Bor (1954) notes that the type sheet of *A. pilosula* Trin. from Trinius's herbarium in Leningrad (Saint Petersburg) has two labels: the first with an affixed inflorescence branch and a drawing of spikelet, lemma, palea and anther and the second in Trinius's handwriting '*Agrostis pilosula* m. *Lachnogrostis scobro* N. ab Ess. in hbio. Royle, Ind. reg. mont. sup. No. 72'.

Steudel (1840, 1841) made no reference to *V. scabra* P.Beauv. in relation to the Nees annotation, although he did note (Part 2, p.768) that *V. scabra* P.Beauv. was an *Agrostis* species according to Trinius. As Steudel (1840, 1841) assigned both *A. scabro* R.Br. and *A. rudis* Roem. & Schult. to *Calamagrostis rudis* Steud. (Part 1, p. 42), it is obvious that Nees's '*Lachnogrostis scabra*' annotation on the specimen from the herbarium of John Forbes Royle was applied to a collection likely derived from the Himalayas in Northern India, where the majority of Royle's collecting took place (Harrison 1978), rather than to any Australian collection. In fact, Bor (1954) found three specimens in Royle's own herbarium (now at the Liverpool World Museum) labelled as '*Lachnagrostis scabro* N. ab E.' (i.e. Nees von Esenbeck): 'Huttoo', '187/73' and '187/267'. He also found an accompanying slip in Nees's handwriting stating '187/72 & 73 *Lachnogrostis scabro* Simla [i.e. Shimla, Himachal Pradesh, Northern India], Mussooree [i.e. Mussoorie, Uttarakhand, Northern India], Huttoo [i.e. Mount Whartoo near Kotgarh, Himachal Pradesh]'. He identified '187/267' as *Poa nemoralis* L. but concluded that 'Huttoo' and '187/73' were conspecific, with the former being a duplicate of *Royle's No. 72* (i.e. 187/72), which is the type (in LE) of *A. pilosula* Trin.

Steudel (1854) used *Wallich 3775a* as the type for *A. wallichiana* Steud. Bor (1954) noted, however, that Bentham identified the Kew specimen *Wallich 3775a* (Wall. L3775a) as Trinius's *A. pilosula* Trin. and Hooker (1896) mistakenly cited the same specimen as the type for *Colamogrostis pilosulo* (Trin.) Hook f., which he based on *A. pilosulo* Trin.

The only reference to *V. scobro* P.Beauv. by Trinius is in the index of Trinius (1824) where he notes it as '*Agrostis ? Lachnagrostis ?*'. Also in the index to this work, he notes both *A. scabra* Br. and *A. rudis* Br. as '*Lachnogrostis*', but only the latter appears in both the index and the body of the publication as '*Lochnogrostis rudis* Trin.'. Both here and earlier in Trinius (1820), he designates Br. (i.e. R.Br.) as the authority for *A. rudis*, which, as Vickery (1941) pointed out is incorrect as this was not a Robert Brown name but should have been ascribed to Roemer and Schultes (1817). Trinius (1841) lists *A. scabra* Willd. as a synonym of *A. michouxii* Trin. but makes no mention of *A. scabro* R.Br. Despite Trinius's incorrect designation of the authority for the basionym, the correct name for Rough Blown-grass is *Lachnagrostis rudis* (Roem. & Schult.) Trin.

## Morphological examination

Since the assessment by Brown (2006) of collections of *Lachnagrostis rudis*, further collections have been examined from a range of additional south-eastern Australian sites, including: seepage zones along Ellard's Creek at Piccaninnie Ponds and dune swales in the Little Dip Conservation Park in south-east South Australia; on the banks of the Crawford and Glenelg Rivers near Dartmoor, along a limestone creek at Battersby Landing and in burnt heathland between Kentbruck and Moleside Creek in south-west Victoria; in shaded woodland at Main Creek near Bushrangers Bay and in *Melaleuca ericifolia*-dominated wetlands at Boneo on the Mornington Peninsula, Victoria; and from the beds of drying lagoons and along the banks of tidal streams on Flinders Island, Tasmania.

While all of the newly examined mainland populations contain typical *L. rudis* subsp. *rudis* plants, a few (Piccaninnie Ponds, Little Dip, Crawford River and Main Creek) also have plants with long-awned lemmas as described for subsp. *curviseta* by Brown (2006). This subspecies was based on the then only known collection from Sherbrook River near Port Campbell, Victoria – the only distinguishing feature being the slightly curved lemma awn from 1.0–1.4 mm long, compared to subsp. *rudis* with either awnless lemmas or with awns usually 0.1–0.7 mm. While some plants from Piccaninnie Ponds, Little Dip and Main Creek have some lemmas with awns to 1.4 mm and even to 1.8 mm long, they are morphologically similar to *L. rudis* subsp. *rudis* in all other respects and indicate that awn length is not clearly distinctive. As a result, subsp. *curviseta* is reduced to synonymy with subsp. *rudis* and the descriptions of Brown (2006) and Jacobs and Brown (2009) updated accordingly.

In contrast to the other longer-awned populations noted above, the Crawford River population consists of both typical plants with awnless lemmas (sometimes with a minute bristle) and fertile anthers (Fig. 1m–q) and atypical plants with variously awned lemmas and largely empty sterile anthers (Fig. 1f–l). All of these plants were growing sympatrically with small but typical plants of *L. filiformis* (Fig. 1a–e). As the sterile plants have morphological forms that bridge those of *L. rudis* and *L. filiformis*, it seems highly probable that they represent hybrids between the two established taxa. A further collection from the Glenelg River, near its junction with the Crawford River and approximately 350 m west of the Crawford River collection site, appears to be of hybrid origin only. These supposed hybrids are described below as *Lachnagrostis* ×*ripulae* A.J.Br.

Recent collections made on Flinders Island confirm the dwarf stature of these plants and the small inflorescences and spikelets (Fig. 2) reported by Brown (2006) for a number of previously examined collections. Growing one of the newly collected populations (Camerons Inlet) from seed under nursery conditions increased its height, culm length, leaf width and inflorescence size in comparison with field populations, but not relative to a typical mainland population (Moleside Creek) (Table 1) and is suggestive of an underlying genetic differentiation. This finding was supported by a difference in 2C-value found by Brown (2013): 15 pg for Moleside Creek and 19 pg for Camerons Inlet. The mean

**Table 1.** Mean growth and inflorescence measurements for nursery and field grown *Lachnagrostis rudis* accessions from Moleside Creek, SW Victoria, and Camerons Inlet, Flinders Island

| Accession | Plant height[1] (cm) | Culm length[2] (cm) | Leaf width[3] (mm) | Inflorescence nos. | Inflorescence size (h[4] x w) |
|---|---|---|---|---|---|
| Field sample | | | | | |
| Moleside Creek | 51.5 | 70.3 | 3.4 | - | 18×12 |
| Camerons Inlet | 12.7 | 20.3 | 1.1 | - | 9×11 |
| Nursery sample | | | | | |
| Moleside Creek | 31.5 | 77.5 | 8.6 | 19.5 | 22×11 |
| Camerons Inlet | 15.8 | 47.0 | 3.3 | 40.3 | 12×12 |

[1] height without fully exserted inflorescences
[2] overall height
[3] at broadest point on widest leaf
[4] from lowest whorl

**Figure 1.** Probable parental and hybrid plants from Crawford River, Victoria. *Lachnagrostis filiformis*: **a.** part tussock ×0.3; **b.** floret ×10; **c.** spikelet cluster ×5; **d.** anther ×10; **e.** spikelet ×10. *L.* ×*ripulae*: **f.** floret ×10; **g.** spikelet ×10; **h.** shrivelled anther ×10; **i.** spikelet cluster ×5; **j.** part tussock ×0.3; **k.** floret ×10; **l.** spikelet ×10. *L. rudis*: **m.** spikelet ×10; **n.** floret ×10; **o.** anther ×10; **p.** spikelet cluster ×5; **q.** part tussock ×0.3 (**a–e** *A.J. Brown 2414*; **f–i** *A.J. Brown 2419*; **j.** *A.J. Brown 2415*; **k–l** *A.J. Brown 2416*; **m–q** *A. J. Brown 2412*).

standard deviation for repeated flow-cytometry analysis on 26 *Lachnagrostis* samples reported by Brown (2013) is calculated to be 1.4 pg and indicates that the 2C-value difference between the *L. rudis* accessions is significant. Brown (2013) made 2n chromosome counts of 42 or 49 for the Moleside Creek accession, equating to ploidy levels of 6x (hexaploid) or 7x (heptaploid) and calculated mean genome sizes of 2.14 or 2.50 pg. If it is assumed that the genome size (i.e. additive chromosome size) for the two accessions is the same, the ploidy level of the Camerons Inlet accession is calculated to be 19/15×6 = 7.6 pg or 8x (octoploid) or 19/15×7 = 8.87 pg or 9x (nonaploid). Stable fertility is more likely in the hexaploid (Moleside Creek) and octoploid (Camerons Inlet) scenarios. Brown (2006) did not segregate the dwarf form of *L. rudis* due to the overlapping ranges in morphological measurements between plants of the Bass Strait Islands and the mainland. However, there does appear to be sufficient evidence for segregation of a smaller set of populations, largely, if not exclusively restricted to Flinders Island. Future field and cytological work may elucidate a wider distribution. On the basis of this evidence, a new subspecies is described below as *Lachnagrostis rudis* subsp. *nana* A.J.Br.

## Taxonomy

In order to clarify the nomenclature of the Australian taxon *Lachnagrostis rudis* (Roem. & Schult.) Trin, the nomenclature of some extra-Australian species (*Agrostis scabra* Willd., *Agrostis hyemalis* (Walter) Britton, Stern & Poggenb., *Agrostis pilosula* Trin. and *Calamagrostis scabra* J.Presl.) is presented first.

***Agrostis scabra*** Willd., *Sp. Pl., ed. 4 [Willdenow]* 1(1): 370 (1797)

*Vilfa scabra* (Willd.) P.Beauv., *Ess. Agrostogr.* 16, 148, 182 (1812); *Agrostis hyemalis* var. *scabra* (Willd.) H.L.Blomq. *The Grasses of North Carolina* 82 (1948).

***Type:*** 'America borealis'; holotype: Anon., S-G-270 (chosen by Willd.), photo seen; isotype: Canada, *T. Haenke s.n.*, MO-123101, photo seen.

***Notes:*** This is not a complete synonymy of this taxon. Some authors regard *Agrostis scabra* as a synonym of *A. hyemalis* (Walter) Britton, Sterns & Poggenb. but most treat it as a separate taxon.

*Agrostis scabra* Willd. was not definitively designated as the basionym for *Vilfa scabra* P.Beauv. by Palisot de Beauvois, who either included *A. scabra* R.Br. as an alternative possible basionym or considered the two taxa to be synonymous. However, *A. scabra* Willd. is treated here as the basionym for *V. scabra* P.Beauv. as it is the earlier name.

***Agrostis hyemalis*** (Walter) Britton, Sterns & Poggenb., *Prelim. Cat.* 68 (1888)

*Cornucopiae hyemalis* Walter, *Fl. Carol. [Walter]* 73 (1788); *Agrostis canina* var. *hyemalis* (Walter) Kuntze, *Revis. Gen. Pl.* 3(3): 338 (1898).

***Type:*** holotype: Anon; S-G-256 (small fragment of inflorescence), photo seen; neotype (designated by Ward 2007; verified by Walter 1788): Charleston, South Carolina, *B.L. Robinson 97*, 27.iv.1912, GH00247993 photo seen; isoneotypes: BH *n.v.*, US-866901 *n.v.*

***Note:*** This is not a complete synonymy for this taxon. The orthographic variant '*hiemalis*' was used in many North American publications, but also by Vickery (1941) who included 'with some hesitation' a range of Australian specimens in the 'widespread and variable American species, *Agrostis hiemalis*'. Such Australian specimens have since been segregated into a number of new endemic *Agrostis* taxa by Jacobs (2001).

***Agrostis pilosula*** Trin., *Mém. Acad. Imp. Sci.St.-Pétersbourg, Sér. 6, Sci. Math., Seconde Pt. Sci. Nat. 6*, 4(3–4): 372 (1841) [reprinted as *Agrostidea, II. Callo Rotundo, (Agrostea), Typis Academiae Caesareae Scientiarum* 126 (1841)] nom. nov. for *Lachnagrostis scabra* Nees ex Steud. non *Agrostis scabra* Willd. (1797)

*Calamagrostis pilosula* (Trin.) Hook. f., *Fl. Bri. India [J.D. Hooker]* 7(22): 263–264 (1896); *Lachnagrostis scabra* Nees ex Steud., *Nomencl. Bot. [Steudel], ed. 2.* 1: 250 (1840); *Calamagrostis pilosula* var. *scabra* (Nees ex Steud.) Hook.f., *Fl. Brit. India* 7(22): 264 (1896); *Calamagrostis neesii* Steud., *Nomencl. Bot. [Steudel], ed. 2.* 1: 250 (1840) nom. nov. for *Lachnagrostis scabra* Nees ex Steud. non *Calamagrostis scabra* J.Presl. (1830).

***Type:*** 'Ind. orient. reg. mont. super', Royle 72 *fide* Chase and Niles (1962); holotype: LE *n.v.*, isotype: Royle an Herb. LIV *n.v.*

*Agrostis wallichiana* Steud. *Synopsis Plantarum Glumaceorum* 174 (1854); *Colomagrostis pilosula* var. *wallichiano* (Steud.) Hook. f., *Fl. Bri. Indio [J.D. Hooker]* 7(22): 264 (1896); *Agrostis pilosulo* var. *wallichiano* (Steud.) Bor., *Notes on Asiotic Grasses: XVIII. Indion species of Agrostis collected by Royle. Kew Bulletin* 9(3): 459 (1954). *Type:* 'India', *R. Blinkworth for N. Wollich 3775a*; holotype: K000032351–53 photos seen; isotypes: E00393883, E00393884, E00393885, W0026800 photos seen for all.

***Notes:*** *Agrostis pilosula* Trin. and *Calamagrostis neesii* Steud. are not superfluous names for *Lachnagrostis scabra* Nees ex Steud. as the name '*scobro*' was already occupied by *Agrostis scabro* Willd. and *Calamagrostis scabra* J.Presl., respectively.

In regard to typification, after extensive examination of *Agrostis* specimens collected in India by John Forbes Royle, Bor (1954) concluded that *Royle 72* is the type for *L. scabro* Nees ex Steud. However, Hooker (1896), in discussion under *C. pilosula* (Trin.) Hook.f., incorrectly regarded *Wollich 3775o* as the type for *A. pilosulo* Trin. while also specifically listing this collection under *C. pilosulo* var. *wallichiona* (Steud.) Hook.f. (of which it is indeed the type). In addition, Hooker (1896) introduced *C. pilosulo* var. *scabra* (Nees ex Steud.) Hook.f., under which is listed *L. scabra* Nees ex Steud. (upon which the name *C. pilosulo* is ultimately based). Following Article 26.2, it is possible that one or more of these names for infraspecific taxa of *C. pilosulo* as introduced by Hooker (1896) are invalid, because the infraspecific taxon that includes the type should have been denoted as the autonym, in this case: *C. pilosula* var. *pilosulo*. However, it is beyond the scope of the present paper to resolve this issue, and, in addition, the nomenclatural status of these infraspecific taxa has no bearing on the correct name for the Australian material here placed under *L. rudis*.

This is not a complete synonymy of this high-elevation, variable Asian grass. Consult Bor (1954) for further information concerning the confusing array of associated taxa (many based on collections by J.F. Royle on the Indian sub-continent and in the Himalayas during the 1820s).

***Misapplied:*** *Lachnagrostis scobro* Nees ex Steud. sensu. S.W.L.Jacobs, (2002), A.J.Br. (2006) and S.W.L.Jacobs & A.J.Br. (2009) as *Lachnagrostis scabra* '(P. Beauv.) Nees ex Steud.' [*Lachnogrostis rudis* (Roem. & Schult.) Trin.].

***Calamagrostis scabra*** J.Presl., *Reliq. Haenk.* 1(4–5): 234 (1830)

*Deyeuxia preslii* Kunth., *Enum. Pl. [Kunth]* 1: 243–244 (1833) non *Deyeuxia scabro* Kunth (1829) nom. nov. for *Calamogrostis scabra* J.Presl.; *Calamogrostis canadensis* (Michx.) P.Beauv. var. *scabra* (J.Presl) Hitchc., *Amer. J. Bot.* 21(3): 135 (1934).

***Type:*** **CANADA.** 'Archapelago Montgrave' 'Hab. In Sinu Nootka' [Vancouver Island], *T. Haenke*; holotype: PR, isotypes: US-865764 *n.v.*

***Note:*** This is not a complete synonymy of this subarctic–arctic grass.

***Lachnagrostis rudis*** (Roem. & Schult.) Trin., *Fund. Agrost.* 128 (1820), as '(Br.) Trin.'

*Agrostis scabra* R.Br., *Prodr.* 172 (1810) nom. illeg. non Willd. (1797); *Agrostis rudis* Roem. & Schult., *Syst. Veg.* 2: 360 (1817); *Deyeuxio scabro* Kunth, *Révis. Gramin.* 1: 77 (1829) nom. nov. for *Agrostis scabra* R.Br. (1810) non. Willd. (1797); *Calomagrostis rudis* (Roem. & Schult.) Steud., *Nomencl. Bot.* 2nd edn, 1: 251 (1840–41); *Deyeuxia scobra* Benth., *Fl. Austral.* 7: 583 (1878) *superfluous* nom. nov. for *Agrostis scobra* R.Br. (1810) non. Willd. (1797); *Lachnagrostis scobro* Nees ex Steud. sensu. S.W.L.Jacobs, *Telopea* 9(4): 837 (2002) as *Lachnagrostis scabra* (P.Beauv.) Nees ex Steud.

***Type:*** no location, Anon.; holotype: BM! (reverse of type sheet has pencilled 'Van Diemens Land – Adventure Bay' but noted in Brown (1810) as 'J.D.' [Port Jackson, Van Diemens Land], whereas Brown (2006) concluded that Port Dalrymple, Tasmania was the probable location).

*Agrostis aequoto* Nees in W.J.Hooker, *London J. Bot.* 2: 412 (1843); *Deyeuxia aequota* (Nees) Benth., *Fl. Austrol.* 7: 578 (1878); *Calomagrostis aequota* (Nees) J.M.Black, *Fl. S. Australio* 1: 70 (1922); *Lachnogrostis aequota* (Nees) S.W.L.Jacobs, *Telopea* 9(3): 445 (2001). *Type:* Van Diemens Land, 18.i.1838, *Gunn 1005*; holotype: CGE *n.v.*, probable isotype: K!, syntype: MEL2273954!

*Lochnogrostis scabro* subsp. *curviseto* A.J.Br. *Muelleria* 24: 127 (2006). *Type:* VICTORIA. Sherbrooke River, Port Campbell National Park, 6.ix.1966, *Beauglehole and Finke 21182*; holotype: MEL 1584733!

***Note:*** *Vilfa scabra* P.Beauv. is not listed in the above synonymy, because it is not considered to be based on *Agrostis scobro* R.Br. nom. illeg., but rather is a new combination for *A. scabra* Willd., which is the earlier and legitimate name.

**Key to *Lachnagrostis rudis* subspecies and hybrids**

1 Glumes acuminate; lemma moderately hairy with a strongly geniculate awn attached 50–75% from the lemma base; anthers 0.2–0.3 mm long ..... ***L. filiformis***

1: Glumes acute; lemma glabrous or sparsely hairy and awnless or with a non-geniculate to weakly geniculate awn; anthers 0.3–0.5 mm long ..... **2**

2 Lemma sparsely hairy with an awn from 2–2.5 mm long ..... ***L. ×ripulae***

2: Lemma glabrous (occasionally with a few scattered hairs) and awnless or with a minute bristle or fine, fragile awn to 1.8 mm long ..... **3**

3 Mature plant usually in excess of 50 cm tall, shortly rhizomatous to stoloniferous, culms often geniculate-ascending and sometimes branching; mature inflorescence greater than 10 cm long, usually longer than wide and rather lax; spikelets 1.5–3.0 mm long ..... ***L. rudis* subsp. *rudis***

3: Mature plant to 20 cm tall (including inflorescences), erect to weakly ascending but never branching; inflorescence 10 cm long or shorter, usually as wide as long or wider and rather stiff; spikelets 1.1–1.6 mm long ..... ***L rudis* subsp. *nana***

Green or purplish-green, loosely tufted to rhizomatous or stoloniferous, glabrous, short-lived *perennial* or *annual*, to 80 cm tall or with ascending to geniculate, trailing or scrambling culms to 2 m long, branched or unbranched. *Leaf* blades smooth, filiform or flat, to 15 cm long and 5 mm wide; ligules obtuse, to 2 mm long. *Inflorescence* a sparse, open panicle with spreading, rather lax to somewhat stiff branches to 25 cm long or occasionally more, its base enclosed by the upper leaf sheath but becoming exserted with maturity by up to 15 cm; branches and pedicels green or purple. *Spikelets* 1.1–2.5(–3) mm long, pale to light green or sometimes purplish; glumes acute and keeled, subequal (sometimes the upper up to 0.2 mm longer than the lower), scabrous along the keel and smooth to scaberulous or minutely papillose on the lateral surfaces, particularly towards the apex, margins finely ciliate (at least in the upper half); lemma acute or obtuse, (1.1–)1.3–2(–2.2) mm long, minutely 4-toothed at the apex, usually with the upper nerves and teeth minutely and densely ciliate or fimbriate, body glabrous or very occasionally with a few isolated hairs, callus glabrous or with a few to some hairs 0.1–0.5 mm long, awnless or with a minute near-apical bristle to 0.5 mm long or with a fine, fragile, straight to curved or weakly geniculate awn to 1.8 mm long, arising from within the upper third of the lemma back; palea obtuse, subequal to the lemma and often similarly fimbriate at the apex; rachilla extension glabrous to plumose, (0.1–)0.5–1.5(–1.7) mm long or occasionally absent; stamens 3, anthers 0.3–0.6 mm long.

### ***Lachnagrostis rudis*** (Roem. & Schult.) Trin. subsp. ***rudis***

Green, commonly shortly rhizomatous or stoloniferous, short-lived *perennial* or *annual*, usually 20–80 cm tall but occasionally culms to 2 m long; culms weakly ascending to strongly geniculate and trailing or scrambling, lax, larger examples commonly branched. *Leaf* blades rather lax, smooth, flat, to 15 cm long and 1–5 mm wide. *Inflorescence* generally a sparse, open panicle with spreading but rather lax and somewhat sinuate branches, to 25 cm long or occasionally more, becoming exserted with maturity by up to 15 cm; branches and pedicels green when growing in partial shade but occasionally purplish in more exposed situations. *Spikelets* 1.5–2.5(–3) mm long, pale to light green or sometimes purplish; glumes smooth to finely scaberulous or minutely papillose on the lateral surfaces, lemma acute or obtuse, (1.1–)1.3–2(–2.2) mm long, body glabrous or very occasionally with a few isolated hairs, awnless or with a minute near-apical bristle to 0.5 mm long or with a fine, fragile, straight to curved or weakly geniculate awn to 1.8 mm long, arising from within the upper third of the lemma back, longest awns exceeding glumes by 1 mm (awn length often variable amongst spikelets of the same panicle and plants of the same population); anthers 0.3–0.6 mm long. Probable $2n=42$ chromosomes.

***Note:*** Smaller plants of subsp. *rudis* may approach subsp. *nana* but the combination of inflorescence character, the generally smaller spikelets and awnless lemmas of the latter should suffice to differentiate the two taxa in most cases.

***Distribution:*** Scattered along or within 15 km inland of the southern coastlines of Victoria and South Australia from Lake Tyers to Robe, and on the western to south-western coastline of Tasmania from Trial Harbour to South Cape Bay and Adventure Bay, with isolated occurrences on the north-west coast and on King Island in Bass Strait. Also collected from *Leptospermum lanigerum* (Sol. ex Aiton) Sm. swamp and scrub at Lake Corangamite, Poolaijelo at Salt Creek and Wannon Swamp in Western Victoria.

***Habitat:*** Favours damp ground, including seepage slopes, stream banks and swamps, wet limestone cracks and cliff faces and in sand and rocks above high tide on the fringe of coastal scrub.

***Selected specimens examined:*** **TASMANIA.**Tamar, iii.1887, *Ookden* s.n. (MEL); Trial Harbour, xii.1894, *Rodwoy s.n.* (HO); Ettrick River, King Island, 7.iii.1966, *J.H. Willis s.n.* (MEL); Point Eric, Coxs Bight, 31.xii.1982, *D.I. Morris 82104* (HO); Pennerowne Point, 26.i.1984, *A. Moscol 5942* (HO, AD); Endeavour Bay, 30.i.1984, *A. Moscal 6014* (HO); Wallaby Bay, Port Davey, 8.i.1987, *A.M. Buchonon 9339* (HO); Welcome River, north of Redpath, 17.iv.1996, *L.A.S. Johnson* (HO). **SOUTH AUSTRALIA.** Dry Creek, Glenelg River, 29.xii.1963, *A.C. 8eouglehole 5894* (AD, MEL); Bluff Swamp, Tantanoola, 18.i.1993, *R. Botes 30964* (AD, CANB); Caroline Forest, 7.i.1994, *R. Bates 35759* (AD); Piccaninnie Ponds North, 20.i.2009, *R. Botes 80899* (MEL); Little Dip Conservation Park, xii.2011, *R. Botes 86419* (MEL). **VICTORIA.** Gorae West, ii.1946, *A.C. 8eouglehole s.n.* (MEL); above Tidal River, Wilsons Promontory, 13.i.1967, *J.H. Willis s.n.* (MEL); Lonely Arm, Lake Tyers, 11.xii.1976, *D.G. Comeron 7637* (MEL); Georges Rest, Lower Glenelg National Park, 15.ii.1991, *D. Albrecht 4724* (MEL); Mornington Peninsula, Nepean State Park, near confluence of a gully with Main Creek, 30.xii.1991, *N.G. Wolsh 3281* (MEL); Moleside Creek, 7.i.2009, *A.J. 8rown 2398* (MEL); Boneo, 23.i.2013, *A.J. 8rown 2597* (MEL); Battersby Landing on the Lower Glenelg River, iii.2014, *R. Botes 90105* (MEL); Kentbruck Heath, Glenelg River National Park, iii.2014, *R. Botes 91028* (MEL).

### *Lachnagrostis rudis* subsp. *nana* A.J.Br., **subsp. nov.**

Differs from subsp. *rudis* in its small tufted stature, small, rather stiff panicles and often purple, scaberulous glumes.

**Figure 2.** Spikelets of *Lachnagrostis rudis* subsp. *nana* from Camerons Inlet (left) and *L. rudis* subsp. *rudis* from Moleside Creek (right)

***Type:*** **TASMANIA.** Pot Boil Lagoon, Flinders Island, 15.i.1977, *J.S. Whinray 2223*, holotype: MEL1522881; probable isotypes (as Whinray commonly distributed duplicates with different collecting numbers): *Coll. No. 2306*, CANB487730; *Coll. No. 1522*, AD98108282.

Green or purplish-green, non-rhizomatous and non-stoloniferous, short-lived *perennial* or *annual*, to 12 cm tall or to 20(–50) cm tall including flowering culms; culms erect or weakly ascending but never trailing or scrambling, unbranched. *Leaf* blades smooth, filiform or flat, 4–8(–13) cm long and 0.2–1.5 mm wide. *Inflorescence* an open panicle with divergent and usually rather stiff branches, to 12 cm long from the lowest whorl of branches (commonly wider than long), becoming shortly exserted by 0.5–5(–7) cm at maturity; branches and pedicels purple, or green when immature or in shade. *Spikelets* 1.1–1.6(–1.8) mm long, purple or sometimes green; glumes often scaberulous on the lateral surfaces; lemma obtuse, 1.1–1.4 mm long, body glabrous, awnless; anthers 0.3–0.5 mm long. Probable $2n=56$ chromosomes.

***Distribution:*** Largely confined to the lagoons area of south-east Flinders Island but also at Killiecrankie Creek and North Pats River in the north-west and west respectively. May occur elsewhere on Bass Strait islands or on the Tasmanian or Victorian coast.

***Habitat:*** Growing on the edges of winter-wet, sub-saline lagoons, often in the shelter of *Melaleuca* L. bushes or sedge tussocks. Also along the banks of creeks near their outlets to the ocean.

***Etymology:*** After the Latin: named for the dwarf nature of the subspecies.

***Selected specimens examined:*** **TASMANIA (Flinders Island).** North Pats River, 27 or 29.xii.1975, *J.S. Whinroy 1493, 2205, 2258* (AD, MEL, CANB respectively); Big Stony Lagoon, 31.i.1977, *J.S. Whinray 703* in part (CANB); Killiecrankie Creek, 12.i.1980, *I.C. Clorke 1090* (MELU); E-shaped Lagoon, 4.i.1984, *J.S. Whinroy 8143* (MEL); Long Swamp, 26.v.1984, *J.S. Whinray 8192* (MEL); Hays Lagoon, 6.vi.1984, *J.S. Whinray 8194* (MEL); E-shaped Lagoon, 20.vi.1984, *J.S. Whinroy 8217* (MEL, HO); Killiecrankie Creek, 19.i.2010, *A.J. Brown 2469* (MEL); Camerons Inlet, 19.i.2010 *A.J. Brown 2470* (MEL); Camerons Inlet, 20.i.2010, *A.J. Brown 2482* (MEL); Stoney Lagoon, Patriarch Sanctuary, 21.i.2010, *A.J. Brown 2486* (MEL).

## *Lachnagrostis* ×*ripulae* A.J.Br., **nothosp. nov.**

Apparent hybrid between *Lachnagrostis rudis* and *L. filiformis*, combining the inflorescence and spikelet characteristics of both taxa but with largely sterile anthers. Differs from *L. rudis* in its more congested panicle, longer spikelets, less scabrous and ciliate glumes, more or less hairy lemmas, non-fimbriate lemma and palea apices and longer and lower attached lemmatal awn. Differs from most forms of *L. filiformis* in its stoloniferous growth habit, smaller spikelets, non-acuminate glumes and shorter and non-geniculate lemmatal awn.

***Type:*** **VICTORIA.** Near the Crawford River Bridge on the Dartmoor–Hamilton Road, 29.ii.2008, *A.J. Brown 2416*, holotype: MEL2384078!

Green, shortly stoloniferous, glabrous, *annual*, to 12 cm tall; culms 0.5–1 mm wide, ascending, unbranched. *Leaf* blades smooth, flat, 5–10(–15) cm long and 1–1.5 mm wide; ligules obtuse, to 2 mm long. *Inflorescence* an open and rather lax panicle to 15 cm long from the lowest whorl of branches, its base enclosed by the upper leaf sheath but becoming exserted by 4–5 cm with maturity; branches and pedicels green. *Spikelets* (2.2–)2.5–2.7 mm long, green or sometimes purplish-green; glumes acute and keeled, subequal, scabrous along the keel, smooth on the lateral surfaces, margins smooth or finely ciliate towards the apex; lemma obtuse, 1.5–1.7 mm long, minutely 4-toothed at the apex, with a few scattered hairs to moderately pilose, awned from just above mid-back; awn fine and straight to curved or very weakly geniculate, 2.2–2.5 mm long; callus with 0.5 mm long hairs; palea 1.5–1.6 mm long; rachilla extension to 1.5–1.6 mm long; anthers 0.3 mm long if shrivelled, 0.5 mm long if non-shrivelled, both without or almost without pollen. (Fig. 1f–l)

***Notes:*** Probably a hybrid between *Lachnagrostis rudis* and *L. filiformis* and/or a backcross of this hybrid with *L. filiformis*. There are likely a swarm of hybrids of varying forms. Some plants are to 70 cm tall with inflorescences to 25 cm long and leaves to 3 mm wide but in other respects conform to the type specimen. These plants usually have non-shrivelled anthers but still with limited pollen. Other plants have leaves only to 5 cm long and 1 mm wide, spikelets of only 2.2 mm length and almost

glabrous lemmas (Fig. 1f–g). Again these plants conform to the type in other respects, including shrivelled anthers (Fig. 1h).

The lemma of *L. rudis* is either awnless or possesses a minute, near-apical bristle or an occasional, very fine and fragile, straight to curved awn arising from the upper third of the lemma. In comparison, the lemmatal awns of *L.* ×*ripulae*, although still non-geniculate, are usually more substantial and attached at a lower point.

***Distribution:*** Known only from the Crawford and Glenelg Rivers, near Dartmoor, Victoria.

***Habitat:*** Growing in partial shade along or near the banks of rivers.

***Etymology:*** After the Latin for river-bank.

***Further specimens examined:*** **VICTORIA.** Close to Glenelg River, Fort O'Hare Caravan Park, Dartmoor, 7.i.2007, *R. Bates 76340* (MEL); Crawford River, Dartmoor, 20.i.2009, *A.J.Brown 2240* (MEL); near the Crawford River Bridge on the Dartmoor-Hamilton Road, 4.iii.2008, *A.J. Brown 2417, 2418, 2419* (MEL).

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# Muelleria

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# Naturalised species of *Psoralea* (Fabaceae: Psoraleeae) in Australia


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## Introduction

The tribe Psoraleeae (Fabaceae) occurs predominantly in southern Africa, Australia and North America, with outliers in South America, Mediterranean Europe and Asia (Stirton 1981, 2005). *Psoralea* L., comprising some 75 species, is endemic to southern Africa, being mainly restricted to wet montane and lowland fynbos of the Cape Floristic Region, but with a few species extending to eastern and Afromontane regions with outliers in Angola and St Helena Island (Stirton & Schutte 2000). There are also a number of specialised species that have adapted to drier regions (renosterveld, arid fynbos, and sand dunes) and which are found in the Sandveld, Klein Karoo and Namaqualand. The majority of species occur on low nutrient soils derived from Table Mountain Sandstone; a few are habitat specialists and occur on shales, silcrete and limestone.

A number of species of *Psoralea* have become naturalised in other regions (Australia, New Zealand and the United States). This paper reports on the occurrence of Southern African *Psoralea* in Australia giving full descriptions, synonomy, photographs, and a key to the naturalised taxa. One previously unrecorded species, *P. arborea* Sims, is noted as new to the Australian naturalised flora.


## Abstract

Two species of the African genus *Psoralea* L. (Psoraleeae, Fabaceae) have become naturalised in Australia. *Psoralea pinnata* L. is well recorded, and in this paper we report an unrecorded second species *P. arborea* Sims. Full descriptions and distributions in Australia are given for each species and a key is provided.



***Key words*:** biodiversity, flowering plants, invasives, legumes, peas, taxonomy, South Africa


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## Materials and methods

A comparative morphological study was undertaken of available spirit and herbarium specimens (AD, BOL, CANB, BM, HO, K, MEL, NBG, NSW, PERTH, PRU, NH and NU (acronyms follow Index Herbariorum (Thiers 2015))).

## Species treatment

**1. *Psoralea pinnata*** L., *Sp. Pl.* 2: 1074 (1762)

***Type:*** Collector unknown (Hort. Cliff. 370). When the lectotypification was made (Stirton in *Taxon* 41: 568, 1992), only 'Hort. Cliff. 370, *Dorycnium* 1, BM' was cited. However, *Dorycnium* 1 consists of two sheets, annotated A and B, and neither was specified. Under Art. 9.17 it is possible to designate one of these sheets in a subsequent lectotypification. We choose *Dorycnium* 1A accordingly. *Dorycnium* 1B (BM000646706) is a sterile specimen and does not match the protologue. Lectotype, here designated, *Dorycnium* 1A (BM000646705!).

Thunb., *Prodr.* 136 (1800); Poir. in Lam., *Encycl.* 5: 690 (1804); Dietr., *Lex. Gart. Bot.* 7: 612 (1807); DC., *Prodr.* 2: 216 (1825); Eckl. & Zeyh., *Enum.* 224 (1836); E. Mey., *Comm.* 82 (1836); Reichenb., *Ic. Descr. Pl. Cult.* t.97, f.1 (1823); Harv. in Harv. & Sond. *Fl. Cap.* 2: 144 (1862); Forbes in *Bothalia* 3: 125 (1930); Salter in Adamson & Salter, *Fl. Cape Penins.* 485 (1950); Kidd, *Wild Flow. Cape Penins.* t. 81.12 (1972); Pitman and Palmer, *Trees S. Afr.* 2: 920 (1972); Bond & Goldblatt, *Pl. Cape Flora* 296 (1984); Gibbs Russell et al., *Mem. Bot. Surv. S. Afr.* 56: 88 (1987). For fuller synonymy see Stirton and Muasya (unpublished manuscript 2015).

For Australian treatments and records of naturalisation see: Hooker (1859); Blakely (1923); Gardner (1925); Beadle, Evans and Carolin (1962); Curtis (1975); Weber (1986); Jeanes (1996 p.p., not fig. 138a); Grieve (1998); Blood (2001); and Norris and Harden (2002). For New Zealand see Kirk (1870); Cheeseman (1883, 1885); Allan (1937); Webb, Sykes and Garnock-Jones (1988).

***Vernacular names:*** Australia: African Scurf-pea, Blue Butterfly Bush, Blue Psoralea, Taylorina. Western Australia: Albany Broom, Blue Broom. New Zealand: Dally Pine. South Africa: Bloukeur, Fonteinbos, Fountain Bush, Penwortel, Pinnate-leaved Psoralea.

*Much-branched shrub to small tree* up to 5 m tall. *Stems erect*, 1(2), **yellowish tan with storied white lenticels when young**, becoming grey with age. Branches and twigs angular, sparsely hairy when immature. *Stipules* **fused for most of their length**, subulate, with incurled margins, hairy, **overlapping like short stacked planks, becoming woody with age**. *Leaves* 7–9-foliolate, imparipinnate, 25 mm long, 45–50 mm wide, **villoso-pubescent**, terminal leaflet shortest, basal pair longest, petiolate. *Leaflets* linear or linear-lanceolate, 20–45 mm long, 0.8–2.0 mm wide, acute to acuminate, dark green, glandular. *Petiole* 4–7 mm long, rachis 10–15 mm long. *Inflorescences* **hidden within leaves, borne on short shootlets which are spread along the length of seasonal shoots, pseudo-spicate or pseudo-capitate**, axillary, **weakly scented or odourless**. *Flowers* 14–18 mm long, pale mauve to blue, axillary, **sessile or subsessile**, 1–6 per axil, subtended by a pinnate leaf; bracts a **fused trifid cupulate structure situated at apex of a 2–5 mm long pedicel, overlapping the base of the calyx, carinal tooth longer than other two teeth**, sparsely white hairy, margins ciliate with few black hairs. *Calyx* 8–9 mm long, **glabrescent**, mainly white-haired but also with black hairs on margins, or a mixture of black and white hairs, **teeth dark green**, shorter than yellowish green tube; ovate-acute to triangular. *Standard petal* 15–16(–18) mm long, 11 mm wide, **obovate**, white suffused with pale mauve in the central area and with a single purple 3–4 mm long flash situated between and above the free swollen callosities at the top rim of the claw; **veins hyaline**. *Wing petals* 13–14 mm long, 4 mm wide, longer than keel petals; white to pale mauve, blade folded and puckered along the mid-line; sculpturing present. *Keel* 12 mm long, 3.5–4.0 mm wide; white to pale mauve, shorter than wings. *Androecium* **6–7 mm long**. Pistil 12 mm long; ovary 2 mm long, covered in club-shaped glands; style filamentous but thickened at point of flexure, stigma penicillate. *Fruits* 4–5 mm long, 2.5–3.0 mm wide. *Seeds* 1.2–4 mm long, dark brown to black. (Fig. 1)

***Specimens examined:*** **WESTERN AUSTRALIA.** Albany, x.1867, *F. Mueller s.n.* (MEL 116942A); Yanchep, Loch McNess, ix.1966, *A.J. & J.A. McComb McC 211* (PERTH, UWA); Lesmurdie Falls, 12.xii.1947, *C.A. Gardner s.n.* (PERTH 04510208); Inlet Drive, Denmark, 11.i.1984, *G.J. Keighery 6512* (PERTH); Mount Barker Hill, 100 m N of Sothard Road, 5 km S of Mount Barker, 7.xii.1987, *G.J. Keighery 9271* (CANB, PERTH); 3.8 km NE of Bakers Junction on road to Jerramungup, 15.xi.1995, *B.J. Lepschi & T.J. Lally 2327* (AD, BRI, CANB, K, MEL NSW, NY, PERTH); From Wheatly Coast Road turn right into Lanepool Road, right side of road,

**Figure 1.** *Psoralea pinnata*. **a.** habit; **b.** inflorescences; **c.** trifid cupulate bract (from *Ross 3818*); **d.** calyx (from *Lepschi 2327 & T.R. Lally*). Photo credits: **a–b**, Charles Stirton; **c–d** Val Stajsic.

Northcliffe, 30.xii.1994, *G.A. Oxnam 99* (NFE, PERTH). **SOUTH AUSTRALIA.** Dismal Swamp, 10 km N of Mt Gambier, xii.1979, *R.J. Bates 566* (AD). **NEW SOUTH WALES.** Swamps between Cooggi [Coogee] and Botany, ii. or xi. (month unclear)1889, *Mr Grant s.n.* (NSW 30589); Waterfall, xi.1913, *C. Shambler snr s.n.* (NSW 820492); Native vegetation between Sayers Street and St Bernard's Drive, Lawson, 4.xii.2003, *C.H. Barker 27 & J.R. Hosking* (CANB, MEL, NE, NSW, TARCH). **VICTORIA.** Port Phillip, xii.1884, *[F.M.] Reader 30* (MEL 116938A); 6.5 km N of Portland P.O., 9.vii.1977, *A.C. Beauglehole 56287* (MEL); Great Ocean Rd, S of Gellibrand River, 3.2 km N of Moonlight Heads turn-off, 20.v.1977, *A.C. Beauglehole 56262* (MEL); 3 km N of Foster on South Gippsland Hwy, 13.iii.1991, *J.H. Ross 3434* (MEL, NSW); Mornington Peninsula, Rosebud, Mornington Peninsula Freeway, 16.xi.1996, *J.H. Ross 3818* (MEL, NY); On Moe–Erica Road, 17.2 km by road from Moe trotting track, c. 200 m S of Wild Cow Track, 9.xii.1997, *P.G. Nelsh 485* (MEL). **TASMANIA.** Lenan Valley, Giblin Street Quarry, 8.x.1998, *A.M. Buchanan 15299* (HO); King Island, Sea Elephant Road, 250 m N of Fraser Road junction, 25.ii.2009, *M.L. Baker 2062 & M.F. Duretto* (HO).

***Flowering period:*** In South Africa, flowering takes place from October to December. In Australia, peak flowering occurs between November and January.

***Ecology and habitat:*** In its native range *Psoralea pinnata* occurs in mountain fynbos, forest margins, and riverbeds at altitudes between 230 and 1060 m and favours damp sandy or peaty locations. In Australia, *P. pinnata* reproduces mainly by seed (shed copiously locally then secondarily dispersed by water) in contaminated soil and in dumped garden waste. On account of the confusion with *P. arborea*, some of the ecological information about *P. pinnata* in Australia will also pertain to *P. arborea*, but based on our examination of specimens from Australian herbaria most of what is currently known about the ecology of the species in Australia holds true. In Australia, *P. pinnata* occupies various vegetation formations along streams, in swamps, heathland, dry coastal vegetation, dry sclerophyll forest and woodland, grassy woodlands, rocky outcrops, disturbed tracks and roadsides, rubbish tips, waste places and quarries. It occurs on sand, loam, clay and rocky soils (Carr et al. 1992; Hussey et al. 1997; Muyt 2001; AVH 2012). Hussey et al. (1997) note that *P. pinnata* has become the dominant vegetation in swamps, creeks and roadsides in the Albany coastal agricultural region in Western Australia. Gilfillan and Barrett (2004) list the species as being a threatening competitor to *Ornduffia calthifolia* (F.Muell.) Tippery & Les, a rare species in Western Australia. Carr et al. (1992) consider it as posing a very serious threat to dry coastal vegetation, heathland and heathy woodland, lowland grassland and grassy woodland, and dry sclerophyll forest and woodland vegetation in Victoria. Muyt (2001) noted that it is highly invasive in Australia in heathlands. As it is an excellent nitrogen fixer it can change the soil fertility and thereby affect the persistence of indigenous species over the long term (Muyt 2001). In New South Wales, *P. pinnata* invades open sclerophyll forest (e.g. *Eucalyptus piperita* Sm. and *Corymbia gummifera* (Gaertn.) K.D.Hill & L.A.S. Johnson woodland, at Lawson) and swamps. In Tasmania, *P. pinnata* is currently only known from disused tips and disused mine sites. As in *P. arborea*, this species produces copious seeds. Regeneration is dependent on fire. If fire episodes are too far apart, the species can become locally extinct. However, one of us (CHS) is aware of 40-year intervals between fires where the species regenerated from seed after most of the parent plants had been absent for over 30 years. Germination is stimulated by fire and, in the long run, dependent on it for regeneration. After fire, the plants produce masses of rapidly growing seedlings with copious production of root nodules associated predominantly with *Mesorhizobium* (Lemaire et al. 2014). It is reported to be one of the key weeds threatening sea bird habitats on Albany's offshore islands (Frodsham 2008).

***Biology in South Africa:*** Not a lot is known about the biology of this species in South Africa. The following notes are provided as useful leads for possible future biocontrol of the species in Australia. Flowers are visited predominantly by large Xylocopid (see Stirton 2007a, 2007b, 2007c, 2007d) and Megachilid bees, which divide large plant colonies into scattered communal feeding trees interrupted by localised adjacent territories of two to five trees, which the bees defend vigorously. Butterflies have been recorded feeding opportunistically on flowers of this species (*Vanessa cardui* (Linnaeus, 1758) – Painted Lady (see Voget 2011)), and there is some evidence that larvae of some butterflies feed on the leaves (see Rebelo 2011; Brink 2013) sometimes forming caterpillar tents (see Van den Bosch 2012). Seeds are heavily infested by Bruchid beetles (Bruchidae, Coleoptera), many of which are known to be species-specific in Cape legumes (Stirton pers. obs.).

Monkey beetles (Tribe Hopliini) feed on flower parts and can cause extensive damage to inflorescences. It should be noted that the Hopliini can be serious pests of cultivated crops and lawns. Xylocopid bees use old wood as nesting sites and the Rooibos Longhorn Beetle (*Ceroplesis aethiops* (Fabricius, 1775)) deposits its eggs on old wood (Stirton pers. obs.). Black aphids can be found on young shoots. Scale insects, such as *Icerya purchasi* Maskell, 1878 (Cottony Cushion Scale), can be common in some areas and are protected by ants (*Camponotus niveosetosus* Mayr, 1862: see Rebelo (2012)). Underground root-feeding pink aphids have also been found (Stirton pers. obs.).

Biocontrol specialists might want to know that there are a number of distinct ecotypes in South Africa. Along Chapman's Peak Drive and in the Silvermine Nature Reserve area on the Cape Peninsula and at Betty's Bay and in the Kogelberg the plants form small trees 4–5 m tall; elsewhere they tend to be shorter untidy shrubs to about 2 m tall.

***Note:*** The treatment of *Psoralea pinnata* in Jeanes (1996) includes a description which is consistent with that species. However, the illustration is clearly of *P. arborea*, as is apparent from the flowers being exerted beyond the leaves, and was confirmed by examination of the voucher (*Lyne 446*).

***Etymology:*** The epithet refers to the pinnate leaves (from Latin: *pinnatus,* feathered, winged).

### 2. *Psoralea arborea* Sims, *Bot. Mag.* 46: t. 2090 (1819)

***Type:*** Bot. Mag. 46: t. 2090 (holo.). No herbarium material has been found that matches the protologue. The painting was made from a cultivated specimen in James Vere's Garden in Kensington that was grown from seed from the Cape of Good Hope. No mention is made of either preserved material or of Sims having seen any other specimens. However, two cultivated specimens in K (both on same sheet) could be considered as candidates for typification. One of these (K000392612) was accessioned on 1st May 1889 after publication of the species and is discounted. The other specimen (K000392611) has been annotated by the author of the species, Sims. He wrote that 'There is no doubt that this is "*P. arborescens*"'. Further research is needed to ascertain when this specimen was accessioned at Kew.

DC., *Prodr.* 2: 216 (1825); G. Don., *Gen. Syst.* 2: 201 (1832); E. Mey., *Comm.* 82 (1836); Walp., *Repert.* 1: 655 (1842); Lock, *Leg. Afr. Check-list*: 458 (1989); Jeanes (1996 as *P. pinnata* p.p., specifically fig. 138a, the voucher of which is *Lyne 446*); non Eckl. & Zeyh. (1836) nec Sesse & Mocino (1889).

*Psoralea pinnata* L. var. *quinquijuga* Eckl. & Zeyh., *Enum.* 224 (1836). *Type:* "in humidis (altit. III) laterum montis Duyvelsberg supra Geele Klee (Cap.)", *Ecklon & Zeyher s.n.* Walpers (1839) synonymised this taxon under *Psoralea arborea* but the type has not yet been found.

*Psoralea pinnata sensu* Palmer & Pitman, *Trees of Southern Africa* 2: 918–919 (1976).

*Psoralea affinis sensu* Hutchinson, *Bot. Mag.* 136: t. 8331 (1910), non Eckl. & Zeyh. (1836).

Verdcourt (2000) refers to this species in the *Flora Zambesiaca* but his species is *P. latifolia* (Harv.) C.H.Stirt. (see note under distribution).

***Vernacular names:*** South Africa: Fonteinbos.

*Large slender shrub to small tree*, 3–5(–10) m tall. *Stems* erect, 1(2), rigid, **diameter up to 50 cm, greenish grey when young**, becoming grey when old with scattered white lenticels. *Stipules* **fused for part of their length**, persistent, shorter than petiole, **margins inrolled, narrowly subulate**, hairy, rapidly senescent. *Leaves* 7–9-foliolate, imparipinnate, 25–30 mm long, 45 mm wide, **glabrescent above, wispily hairy below**, petiolate. *Leaflets* 30–45 mm long, 1–2 mm wide, terminal leaflet shortest, basal pair longest, linear or linear lanceolate, acute, green, glandular. *Petiole* 4–5 mm long, shorter on younger leaves, rachis 10–12 mm long. *Inflorescences* **well exerted from leaves**, in upper

**Key to species of *Psoralea* naturalised in Australia**

**1** Leaflets villoso-pubescent on both surfaces; flowers hidden within leaves, pale mauve to light blue, scentless or faintly scented; pedicels 2–5 mm long terminating in a trifid cupulate bract; calyces mainly white-haired but also with black hairs on the margins, or a mixture of black and white hairs ..... ***P. pinnata***

**1:** Leaflets glabrescent above, wispily hairy below; flowers exerted beyond leaves, deep blue to purple, strongly sweet scented; pedicels 11–35 mm long terminating in a bifid cupulate bract; calyces mainly black-haired (with or without occasional white hairs mainly near base), or mostly black haired with a mixture of black and white hairs on the margins of the lobes ..... ***P. arborea***

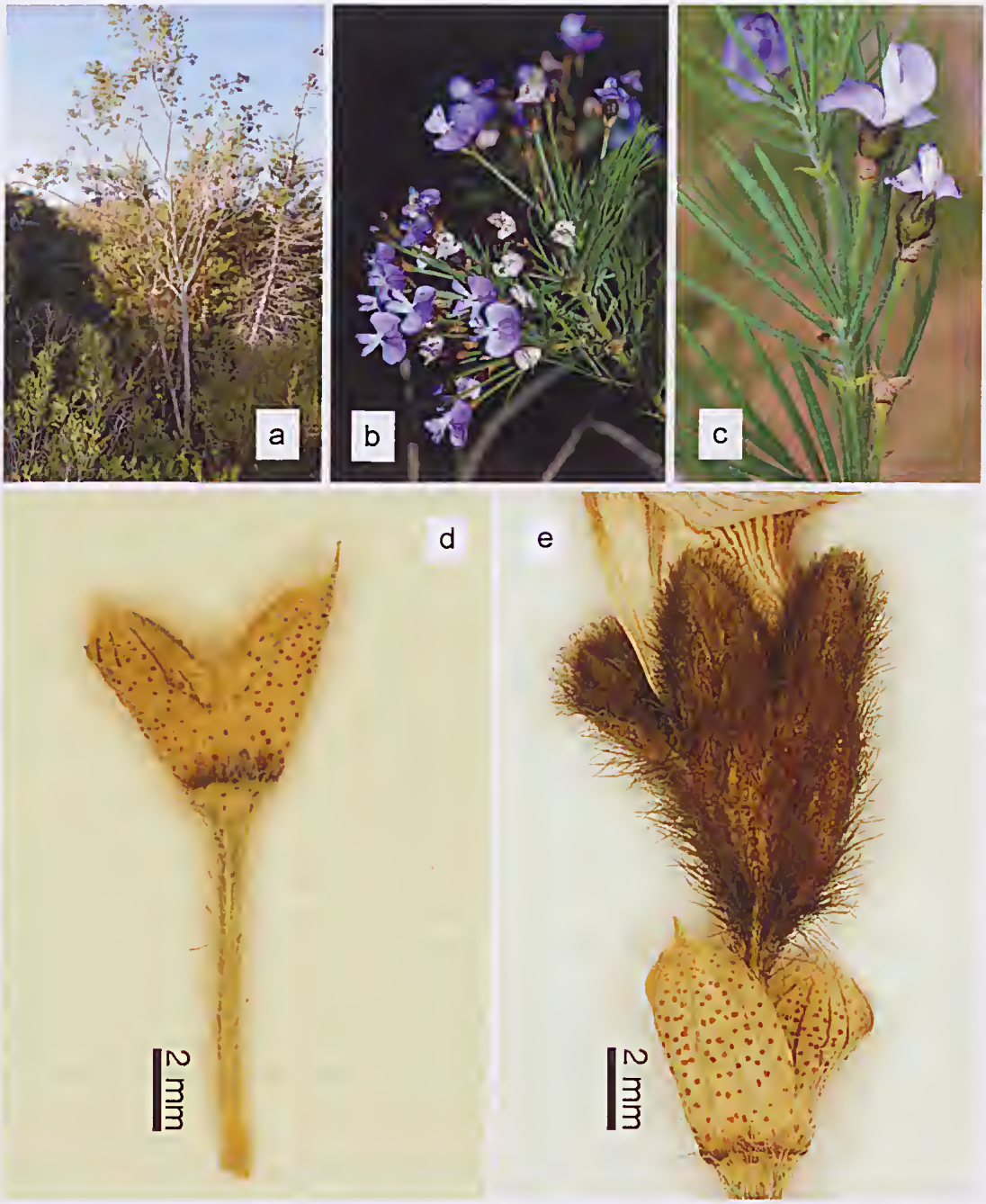


**Figure 2.** *Psoralea arborea:* **a.** habit; **b.** inflorescences; **c.** leaves and flowers; **d.** bifid cupulate bract (from *Lyne 446*); **e.** calyx (from *Lyne 446*). Photo credits: **a–c** Charles Stirton; **d–e** Val Stajsic.

parts of seasonal shoots but without leafy extension, **congested and pseudo-capitate or laxly clustered in axils**. *Flowers* (10–)13–15(–19) mm long, **long pedicellate, 2–3 per axil**, deep blue to purple, **strongly scented**, axillary, each set subtended by a pinnate leaf; bracts a **fused bifid cupulate structure** situated at apex of a 11–35 mm long densely hairy pedicel, **overlapping up to one third of the base of the calyx in bud stage, splitting to base with age**, lower tooth cleft, **teeth equal**, green at anthesis **becoming scarious, straw-coloured and ridged** when old, retained even after seed shed; teeth broadly triangular, acute to rounded, sparsely to moderately covered in short black hairs; glandular, drying orange. *Calyx* 6–8 mm long, **densely hairy**, mainly black-haired with or without occasional white hairs on calyx, mainly near base, or mostly black haired on body of calyx, with a mixture of black and white hairs on margins of calyx lobes; **teeth and tube blackish**, triangular to rounded. *Standard petal* 15–16 mm long, (13.5–)14.5–15 mm wide, **very broadly ovate**; deep blue to purple with large M-shaped white nectar guide with a dark purple flash in crotch, paler towards margins, veins darker than blade. *Wing petals* 14 mm long, 5 mm wide, longer than keel petals; mauve, blade folded and puckered along the mid-line; sculpturing present. *Keel* 10–11 mm long, 3.5–4 mm wide, white, shorter than the wings. *Androecium* **12 mm long.** *Pistil* 6 mm long; ovary 3 mm long, upper end covered in club-shaped glands; style filamentous but thickened at point of flexure, stigma penicillate. *Fruits* 4–5 mm long, 2 mm wide. *Seeds* 3–4.5 mm long, 2 mm wide. (Fig. 2)

***Specimens examined:*** **WESTERN AUSTRALIA.** Forrest Grove Forest Block, SE of Witchcliffe, 29.x.1996, *G.J. Keighery 14611* (PERTH); On the banks of Blackwood River estuary, Augusta, South West, 24.x.1994, *A. Worz* 04.10.24.08 (PERTH). **NEW SOUTH WALES.** West Ryde, 25.xi.1964, *O.D. Evans s.n.* (NSW 920329) (possibly cultivated); South of Prince Henry Hospital, Little Bay towards La Perouse, 20.x.1975, *R.[G.] Coveny 7274 & V. Shonker* (A, K, L, MO, NSW, RSA); La Perouse, Grose Street, edge of Botany Bay National Park, 24.viii.1987, *R.O. Makinson 315 & S. Krouss* (DAO, MEL, NSW); Burill Lake, 06.x.1991, *A.M. Lyne 446* (AD, CBG, MEL, NSW); Bermagui, Haywards Beach, Old Tilba Road, N end of disused section, 18.ix.1995, *N. Schultz 185* (CANB, MEL, NSW); Helensburgh Cemetery, c. 2 km S of town centre, 20.x.1996, *P.C. Jobson 44B5* (CANB, MEL, NSW); Lawson Tip, end of Ridge Road, Lawson, 22.ix.2000, *M. Williams s.n.* (NSW 604386); Nambucca Heads – along track leading to beach, xi.1966, *C. Debenham s.n.* (NSW). **VICTORIA.** Braybrook, 07.x.1976, *C. LeBreton s.n.* (MEL 2184225A) (possibly cultivated); Old Marlo tip, Conran-Marlo Road, c. 1 km E of Marlo, 26.viii.1992, *K. Twyford s.n.* (MEL 2014611A); Old Marlo Tip, Marlo-Conran Road, c. 1 km E of Marlo, 23.ix.1992, *K. Twyford s.n.* (MEL 2013726A). **TASMANIA.** Ironcliffe Road, Penguin, 2 km S of town, 28.xii.1978, *B. Robinson s.n.* (HO 28682); Summit of Hardwickes Hill, 24.xi.1983, *A.M. Buchonon 1751* (HO); St Mary's Pass, 18.xi.1997, *A.M. Buchonon 14901* (HO); Dover Golf Course, 09.ii.1998, *A.M. Buchonon 15073* (HO); Minna Road, ca. 800 m from Bass Highway, Burnie, 30.x.2003, *M. Baker 234* (HO); Eaglehawk Neck, Arthur Highway, 21.xi.2003, *M. Boker 306, A.M. Groy & M.F. Duretto* (HO); Bush opposite motel, Blowhole Road, Eaglehawk Neck, 16.i.2004, *M. Boker 419* (HO); Trial Harbour, N end, at junction of camping area, 15.ix.2004, *M. Baker 609 & A.M. Groy* (HO); Greens Beach, West Tamar Road, just S of built-up area, 31.x.2006, *M.L. Boker 1731, A.M. Buchonon & A.M. Gray* (HO); Flinders Island, Barron, 14.i.2007, *A.M. Buchonan 16654* (HO).

***Flowering period:*** In South Africa flowering takes place from June to December as it does in Australia. Seed is produced from December to February.

***Ecology and habitat:*** In its native range in South Africa *Psoralea arborea* is a species of lowland fynbos, forest margins, vleis (marshes) and inundated areas on black turfy substrates. It has recently become established along roadside ditches and in much drier situations. If it is protected from fire, as in fire-protected valleys in the Koudberg Mountains, this species can grow up to 10 m tall with substantial trunks up to 50 cm d.b.h. (1 m level). It has become seriously invasive in many parts of Australia (Csurhes & Edwards 1998). In Western Australia it has been collected from near a brackish swamp on the banks of Blackwood River estuary, at Augusta, and at an old gravel pit, on lateritic loam near Witchcliffe (Western Australian Herbarium 2008–). In South Africa, *P. arborea* is found between 30–330 m above sea level whereas in Australia it has been collected from elevations between 3–700 m above sea level. The first clearly naturalised plants from Little Bay were noted as being scattered in disturbed areas at the edge of a golf course. It is uncertain whether an earlier specimen collected in 1964 from West Ryde was self-established or planted, the collecting notes 'on footpath, just outside a garden' being ambiguous. In Tasmania it was first collected at Iron Cliff Road, Penguin, on 28 December 1978, but with no habitat and abundance information provided. It occurs along roadsides and escapes into bushland,

and at sites such as Burnie it can form very dense and large populations where it can be dominant such as at Eaglehawk Neck, neglected and disturbed weedy areas, and quarries. Groves et al. (2005) record it as one of the ten most serious invasive garden plants available for sale in Tasmania (referred to as *P. pinnata* in their report).

***Associated species:*** In Australia, *Psoralea arborea* occurs in coastal areas behind fore-dunes at Bermagui, with *Banksia integrifolia* L.f. subsp. *integrifolia* and *Acacia longifolia* subsp. *sophorae* (Labill.) Court, in dry sclerophyll forest, on clay soil at Nungatta State Forest, the Lawson rubbish tip, weedy disturbed open shrubland on siliceous sand at La Perouse, disturbed *Corymbia* K.D.Hill & L.A.S.Johnson and *Eucalyptus* L'Hér woodland, and on gravelly clay at Helensburgh Cemetery. In Victoria, it was collected in a *Banksia* L.f. and *Eucalyptus botryoides* Sm. woodland on an escarpment at the old Marlo tip. The collecting notes indicate that it was common but localised at the time that the collection was made in 1992.

***Biology in South Africa:*** The species is pollinated by Xylocopid bees (e.g. Giant Carpenter Bee – *Xylocopa flavorufa* (De Greer, 1778), (see Marlow 2013)). Seedlings, as in *Psoralea pinnata*, produce copious root nodules (Stirton pers. obs.).

***Etymology:*** The epithet refers to the habit of the plant (from Latin: *arbor*, tree). It is one of the few trees in the genus.

**Figure 3.** Distribution in Australia: **a.** *Psaralea pinnata*; **b.** *P. arbarea*

**Figure 4.** Distribution in South Africa: **a.** *Psaralea pinnata*; **b.** *P. arbarea*

## Distribution and naturalisation

In Australia the *Psoralea* species reported here are naturalised in all states except Northern Territory and Queensland, with differences in their dominance in certain states (Fig. 3a & 3b). *Psoralea arborea* is more widespread than *P. pinnata*, and more commonly collected. In Tasmania, *P. arborea* is certainly the commoner of the two species, *P. pinnata* being rarely collected. In New South Wales, *P. arborea* is the more widespread and more frequently collected species whereas *P. pinnata* is mostly confined to the greater Sydney area. In Western Australia and Victoria, *P. pinnata* is the commoner of the two species. *Psoralea pinnata* is the only naturalised *Psoralea* in South Australia, known only from a 1979 collection from Dismal Swamp, near Mt Gambier, in the far south-east of South Australia.

The earliest probable naturalised record of *Psoralea* in Australia is a Ferdinand Mueller collection of *P. pinnata* collected in October 1867 at Albany in Western Australia (MEL 0116942A). The notes on the collecting label indicate that the species is 'Now in the utmost profusion at Albany. Cannot be extirpated'. *Psoralea arborea* started to become a problem considerably later than *P. pinnata*. The first clearly naturalised plants of *P. arborea* were collected from Little Bay, Sydney, New South Wales, in 1975. In Western Australia, it is known from only two sites: on the banks of the Blackwood River estuary, Augusta, which represents the earliest record of the species in Western Australia, and at Forrest Grove Forest Block, south-east of Witchcliffe, where it is locally common. It is absent in South Australia, and in Victoria it is known from only a single site at Marlo tip, in the far eastern part of the state.

*Psoralea pinnata* is the only naturalised species of *Psoralea* in New Zealand and is mostly restricted to the North Island (Webb 1980; see map in Breitwieser et al. 2010–2015). Early records of naturalisation of *P. pinnata* are (Kirk 1870), Cheeseman (1883, 1913, 1925), Randall Page (1922) and Allan (1937). The pattern of early naturalisation followed a similar pattern to that in Australia. Thompson (1925) noted that in New Zealand this species was reported by Kirk to already occur in the Takapuna District, Auckland, and that 'as it seeds profusely, small specimens are not uncommon in the neighbourhoods of gardens, deserted homesteads, etc. where it can scarcely be expected to become fully naturalised'. Later, however, Cheeseman (1912) had recorded it, on the authority of O. Oakley, as occurring wild at Waipu and threatening to become a nuisance. Further study is needed to track its path of naturalisation in New Zealand.

In their native habitats in South Africa *P. pinnata* (Fig. 4a) and *P. arborea* (Fig. 4b) are endemic to the Western Cape Province. They occupy similar habitats and scarcely overlap in their distribution except in the Hermanus region where they are known to hybridise. *Psorlaea arborea* extends from Stanford to Mossel Bay but has been recorded from Hermanus in the past. All references to this species outside this distribution belong to other taxa (Bello et al. 2014). In its native habitat *P. pinnata* extends from the Cape Peninsula to the Kogelberg Mountains.

*Psoralea* L. emend. C.H.Stirt. has a long horticultural history in Australia, and species have been listed in nursery catalogues, botanic gardens, and floras (Hooker 1859) from the early 1800s. For example, *P. pinnata* was listed in unpublished manuscript ledgers (Fraser 1828) and the published catalogues of J. Bailey's Hackney Nursery in Adelaide (1845) and Shepherd's Darling Nursery in Sydney (1857). However, because plants listed as *P. affinis* Eckl. & Zeyh. and *P. arborea* may also have been misidentified as *P. pinnata*, it will require a more detailed study to track the pathway of naturalisation. *Psoralea affinis*, although not yet an invader, should be considered a potential weed as it is in the same taxonomic group as *P. arborea and P. pinnata*.

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# Muelleria

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# Validation of three new species of *Lecidella* from Australia


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## Discussion

Identifiers issued by a registration authority (Mycobank) were cited for the three new species of *Lecidella* and the one new combination in that genus published by Kantvilas and Elix (2013), as required for valid publication under Art. 42.1 of the *International Code of Nomenclature for algae, fungi and plants* (McNeill et al. 2012). However, for the three new species in particular, the identifiers as issued by Mycobank were incorrectly associated by the authors with the respective species names. In dealing with this situation, one option is to treat the mis-citation of the identifiers as a correctable error, dealt with through a corrigendum. An alternative option is that names should be regarded as invalid under Art. 42.1, because the actual identifier for the name, as issued, was not cited. There is no advice in the *Code* as to the appropriate course of action and there are various opinions within the Nomenclature Committee for Fungi on this matter, including support for both of these two options. Therefore, we opt to validate the three names below, by citation of the correct identifiers and a direct reference to the previously published descriptions. If re-validation turns out not to be necessary, this publication can be treated as a simple corrigendum.


## Abstract

The publication of three species of *Lecidella* described in *Muelleria* 31 (2013) – *Lecidella destituta* Kantvilas & Elix, *L. flavovirens* Kantvilas & Elix and *L. montana* Kantvilas & Elix – is validated by the citation of correct Mycobank identifiers and references to the previously published descriptions.



***Key words:*** *destituta, flavovirens, montana*, publication, lichenised Ascomycetes



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***Lecidella destituta*** Kantvilas & Elix, **sp. nov.**

Mycobank No.: MB803598

***Description:*** See Kantvilas and Elix (2013, p. 32).

***Type:*** **NEW SOUTH WALES.** Gillenbah State Forest, 8 km S of Narrandera, 34°47'51"S 146°30'00"E, 170 m alt., on *Callitris* in mallee scrub, 16 April 2009, *J.A. Elix 39928* (holotype: HO; isotype: CANB).

***Lecidella flavovirens*** Kantvilas & Elix, **sp. nov.**

Mycobank No.: MB803599

***Description:*** See Kantvilas and Elix (2013, p. 37).

***Type:*** **TASMANIA.** Ship Stern Bluff, 43°12'S 147°45'E, 80 m alt., on *Banksia marginata* in coastal scrub, 2 May 2011, *G. Kantvilas 185/11* (HO: holotype; BM, CANB: isotypes).

***Lecidella montana*** Kantvilas & Elix, **sp. nov.**

Mycobank No.: MB803600

***Description:*** See Kantvilas and Elix (2013, p. 40).

***Type:*** **TASMANIA.** Falling Mountain, 41°55'S 146°06'E, 1480 m alt., on twigs of *Diselma archeri* in alpine heathland, 11 March 2011, *G. Kantvilas 137/11* (holotype: HO).

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# Muelleria

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# Correction to the type citations of some *Eucalyptus* from Victoria in Rule (2012), *Muelleria* 30, pp. 83–105


K. Rule

c/o National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria, 3141, Australia


## Correction

Rule (2012) published five new endemic species of *Eucalyptus* L'Her. from Victoria. Type material of several of these species was provided to the National Herbarium of Victoria (MEL) with duplicates assigned to other herbaria. However, for two species (*Eucalyptus yarriambiack* Rule and *Eucalypus aurifodina* Rule) the duplicates were not all referred to in the final publication. In addition, for one species, *Eucalyptus conferta* Rule, a collection was lodged at MEL annotated by the author as 'Type', but this collection (*Rule 0410*, MEL 2369265) is not the collection cited in the protologue as the type. The type as cited in the protologue (*Rule 0210*) is lodged in MEL; however, it was indicated in Rule (2012) as having isotypes at three other herbaria – whereas in fact there is but one isotype at CANB. The three names as published are all valid, but the new information provided in Table 1 will assist herbarium curators in correctly labelling type material. Minor corrections are also provided for some geographic coordinates and dates. Type citations of the other two species published by Rule (2012), *Eucalyptus bunyip* Rule and *Eucalyptus carolaniae* Rule, are correct in the original publication.

## Reference


Rule, K. (2012). Five new endemic eucalypts for Victoria. *Muelleria* **30**, 83–105.


**Table 1.** Corrections to type specimen citation for three of the species of *Eucalyptus* published by Rule (2012)

| Species | Type specimen citation in original publication | Correct citation |
|---|---|---|
| *Eucalyptus yarriambiack* | Victoria: Henty Highway, 1.6 km N of Brim, 36° 03′ 41″ S, 142° 25′ 13″ E, *K. Rule 2605*, 18.iii.2005. HOLO: MEL. | […] 36° 03′ 45″ S […]<br>HOLO: MEL 2369263. ISO: AD, CANB, NSW. |
| *Eucalypus aurifodina* | Victoria: Maldon Historical Reserve, c. 200 m N of Smiths Reef Track along Tatt Town Track, 37° 01′ 04″ S, 144° 06′ 02″ E, *K. Rule 3905 & E. Perkins*, 30.iv.2005. HOLO: MEL. | […] 37° 01′ 00″ S, 144° 06′ 03″ E […] 03.v.2005.<br>HOLO: MEL 2369266. ISO: AD, CANB, K, NSW, S. |
| *Eucalyptus conferta* | Victoria: Fryers Range, Vaughan Springs Road, c 700 m S of intersection with Green Gully Road, 37°12′ 53″ S, 144°14′ 32″ E, *K. Rule 0210*, 7.iv.2010. HOLO: MEL; ISO: AD, CANB, NSW. | HOLO: MEL 2375889. ISO: CANB. |


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# Correction to the 'Key to *Xanthorrhoea* in Victoria' in Bellette (2014), *Muelleria* 32, pp. 8–15

## Correction

An error was created at the production stage for the 'Key to *Xanthorrhoea* in Victoria' (Bellette 2014, p. 13) from the fourth couplet onward. The correct key is published below.

## Reference


Bellette, M.P. (2014). Studies of the distribution and taxonomy of *Xanthorrhoea glauca* subsp. *angustifolia* (Xanthorrhoeaceae) in Victoria. *Muelleria* **32**, 8–15.


**Key to *Xanthorrhoea* in Victoria**

1 Flower-bearing axis (spike) of the inflorescence shorter than or equal to the non-flowering axis (scape); sepals and bracts between flowers usually hairy; stem subterranean or up to 0.6 m high ..... 2

1: Flower-bearing axis (spike) of the inflorescence longer than the non-flowering axis (scape); sepals and bracts between flowers subglabrous to glabrous; trunk usually well-developed, up to 5 m high, or sometimes absent ..... 4

2 Cluster bracts not prominent except at the base of the spike ..... ***X. resinosa***

2: Cluster bracts prominent for at least part of the inflorescence ..... 3

3 Leaves usually about 3.2–7 mm wide, grey, glaucous; scape 90–120 cm long. Packing-bracts fringed with hairs to moderately hirsute ..... ***X. caespitosa***

3: Leaves 1.9-3.5 mm wide, green, not glaucous; scape 30–60 cm long ..... ***X. minor* subsp. *lutea***

4 Packing bracts subulate ..... 5

4: Packing bracts tending narrowly triangular to triangular, acute, usually subglabrous, dark or light brown in colour; leaves blue-green to greyish, often glaucous ..... ***X. glauca* subsp. *angustifolia***

5 Leaves 5–12 mm wide, bluish, very glaucous; scape 80–120 cm long ..... ***X. semiplana* subsp. *semiplanaa***

5: Leaves 1.2–3.1 mm wide, often green, or occasionally bluish or glaucous; scape usually less than 60 cm long ..... ***X. australis***

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# Correction to synonymy of *Olearia tenuifolia* in Walsh (2014), *Muelleria* 32, pp. 34–38


**Neville Walsh**

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## Correction

In Walsh (2014, p. 36), the name *Olearia rupicola* J.H.Willis (nom. inval.) was mistakenly included in the synonymy for *Olearia tenuifolia* (DC.) Benth. This unpublished name should appear as a synonym of *O. curticoma* N.G.Walsh, published on the same page of the article.


## Acknowledgement

I'm grateful to Tony Bean (BRI) for pointing out this error.


## Reference


Walsh, N.G. (2014). Notes on *Olearia* (Asteraceae: Astereae) in south-east Australia: *O. tenuifolia, O. adenophora* and description of a new species endemic to eastern Victoria. *Muelleria* **32**, 34–38.


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## MUELLERIA INSTRUCTIONS FOR CONTRIBUTORS

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